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THE PASTORAL FRINGE IN HAWKES BAY

P. N. D. PIRIE

IT HAS TAKEN little more than a century to transform New Zealand from a land of sparse Maori population and native vegetation to one in which the area of effective and productive occupance approaches, but has by no means reached, an economic limit. The true pioneer, once the most characteristic and one of the most significant elements in the population, has almost vanished. But despite all the progress made, characteristics usually associated with pioneering remain a feature of the geography of some parts of New Zealand.

THE PIONEER FRINGE

The study of pioneer areas has interested geographers overseas.[1] In New Zealand, the scope for such studies is now rather limited, but some of the generalisations derived from work overseas still have application in parts of this country. Perhaps the most useful is Bowman's definition of 'pioneer living' as entailing 'a low degree of control by the land settler over the instruments of power'.[2] When the disadvantages of many areas in which settlement in the past has progressed slowly are analysed, it is often found that Bowman's definition, although rather vague and subjective, does emphasise the more important difficulties common to pioneer farming. The hard conditions under which settlers in many parts of New Zealand must farm are imposed both by the nature of the land and by the lack of cultural resources which would help to minimise the disadvantages. The products from 'fringe' farms are bought on the same basis as those from the better farmlands, but the farmer must meet all the extra costs of production on land of poor quality. His only compensation is that his land is cheap and his rates are low. In New Zealand working conditions for farmers on much of the poorer land are often at this pioneer level. Such areas of poor land cannot be accurately described as being part of a pioneer fringe, because of their long-settled character, but they are sufficiently distinctive to be profitably studied from the geographic point of view. The pastoral fringe in Hawkes Bay is a good example of this type of country, and its geographic characteristics are typical of other such similar areas.

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[1] See especially Isaiah Bowman: *The Pioneer Fringe,* Amer. Geogr. Soc. Special Publication, No. 13, New York, 1931.

[2] *idem:* 'Settlement by the Modern Pioneer', in Griffith Taylor (ed.): *Geography in the Twentieth Century,* London, 1951, p. 48.

Fringe Characteristics in Hawkes Bay

Before white settlement, the pastoral fringe in Hawkes Bay was covered with bracken-fern (*Pteridium esculentum*) except for patches of forest growth—a few podocarp forest remnants of the original cover—and light bush in the deep valleys and gorges. Over most of the area, the soil is pumiceous, light and infertile, and the rainfall is high. Under such conditions the strong tendency to reversion on cleared land has imposed 'pioneer living' for generations after the original settler began farming. This is much more typical of Hawkes Bay than of areas where true pioneering is a feature. Settlement within the area came at different times and achieved varying degrees of success, so that today individual farms show great differences in quality, not so much because of the natural conditions but because of the varying opportunities owners have had to apply the most successful farming methods.

Good farming using modern approved techniques needs capital, and the degree to which this is available largely determines the extent and quality of management. Compared with many other parts of the world, farming in this pastoral fringe is mechanised, living comfortable, and transport facilities adequate, but in none of these ways can the fringe be favourably compared with neighbouring areas of better quality. Progress within the last thirty years has been rapid, but if anything, the gap between the conditions on farms in remote areas, and those on more easily farmed land has widened. In the zone where the characteristics of the true fringe country fade, and the hazards of farming become less severe and unpredictable, control over the land, while never complete, does allow most of the labour to be devoted to actual production rather than be dissipated in constant maintenance. The zone in which this occurs forms an obvious limit to the area of pastoral fringe in Hawkes Bay, and may be represented approximately on the map by a single line. More obvious and more definite is the line which shows the present limits of grazing. These two lines converge in the south. In the north the line separating country integrated economically with Hawkes Bay and that integrated with Gisborne is used as the third boundary. These three lines enclose a region distinguished by pastoral-fringe characteristics (*Fig.* 1).

HISTORY OF THE PASTORAL FRINGE

The first land within the fringe intended for white settlement was bought in 1851, and by 1865 most of the region had been acquired by the government, subdivided, and offered for settlement. After 1862, private buyers were allowed to buy land direct from the Maori. High prices for wool at this time encouraged settlement on the previously neglected fern country. However, the attitude of the Maoris to white settlers gradually hardened, and ill-feeling culminated in the Hau Hau troubles. Te Kooti's activities near Wairoa, particularly after the massacre at Mohaka in 1869, thoroughly alarmed the new settlers, who abandoned their isolated little whares, the nuclei of future sheep stations, and fled to the towns. During the 1880's, however, progress was rapid, and the whole of the present pastoral-fringe region was occupied, and sheep runs extended far beyond into country now considered worthless as grazing land. The method of breaking-in was usually to burn the existing vegetation, and sow grass seed on the ashes —a pioneer technique common in many parts of New Zealand and generally successful. In this region, however, the bracken fern reasserted itself repeatedly, each time a little weaker from each year's savage burn and the chewing and trampling of thousands of emaciated merino sheep. When the fern was finally overcome, very often, manuka (*Leptospermum scoparium*) infinitely worse, took its place. This too, had to be burnt or attacked painfully with slashers. Farming showed from the beginning a characteristic which is noticeable even today—of succeeding not necessarily where the land was best suited to it, but where the pioneers stubbornly refused to admit failure.[3]

After 1900 the management of large estates began to give way to more intensive methods of farming on smaller properties. Communications slowly improved, and with more rapid transport and the decline of timber milling many settlements began to contract in size. War and depression further inhibited settlement, whilst, on the other hand, occasional booms provided insufficient inducement to resettle beyond the limits of the established area. With subdivision, the decline in fertility became more noticeable. Soil erosion developed on a large scale. Destruction by earthquake in 1931, followed by disastrous flooding and slip erosion in 1938, large-scale invasion by manuka, declining fertility, and poor prices for wool and meat all made the decade before 1939 an unhappy one for fringe farmers. The outbreak of war caused an acute labour shortage, and manuka, rabbits, and blackberry increased alarmingly. Since the second World War, however, the pastoral fringe has entered into a new and better phase of its development.

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[3] H. Guthrie-Smith: *Tutira*, Edinburgh, 1953 (Third Edition), Ch. XXI.

Present-day Features of the Fringe

The higher prices for wool and meat have made possible the investment of large amounts of capital by the farmers of the fringe, in particular to improve their lands and to combat pests. The continued labour shortage, still one of the main unsolved problems of the fringe, has in part been overcome by the greatly increased mechanisation and by the introduction of new forms of management.

Throughout the region there is a combination of rugged, sharply-dissected hill country, rolling pumice downland, and small separated flood plains and river flats. The soils which have developed on this country are, except for those on the alluvial lowlands, naturally unproductive and deficient in humus, nitrogen, phosphate, and some trace elements, particularly cobalt. All contain some pumice material; some are almost pure volcanic ash. The climate is characterised by high rainfall: few areas have a mean annual rainfall of less than fifty inches, while some have totals approaching 100 inches. The number of sunshine hours is, however, high, and the temperatures remain equable, although lower than in the rest of Hawkes Bay, particularly in winter. High winds, usually from the northwest, are common. The incidence of severe storms of cyclonic origin which bring rains of extraordinary intensity is one of the greatest hazards to farming. Floods, such as those of 1924, and particularly the Esk Valley flood of 1938, have left in their train damage to communications and, worse, to pastured surfaces which is still evident in a few places.

Much of this type of country cannot be worked by machine, and intensive farming is impracticable in most areas. Scrub, fern and second growth have to be checked constantly, while noxious weeds threaten to take control of pastures or to poison stock. Liability to rabbit infestation and extreme risk of soil erosion are further difficulties with which fringe farmers must cope. Access is often difficult and roads are frequently

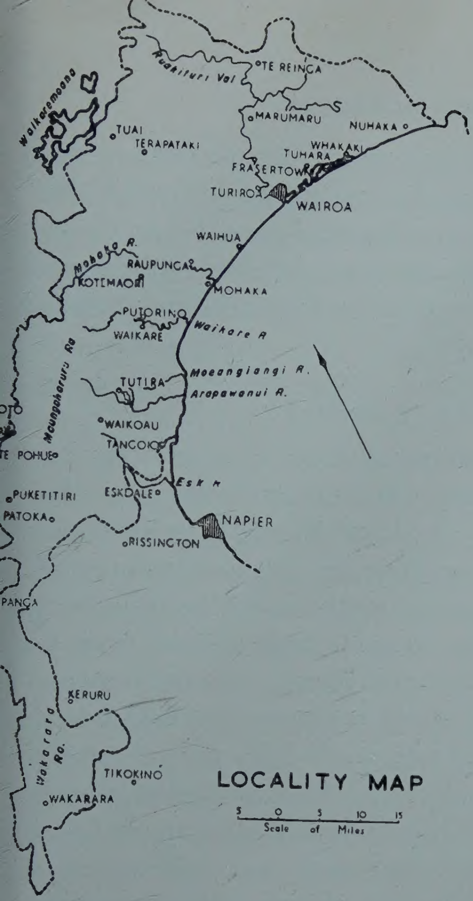

Fig. 1. The pastoral fringe in Hawkes Bay (boundary shown by the broken line).

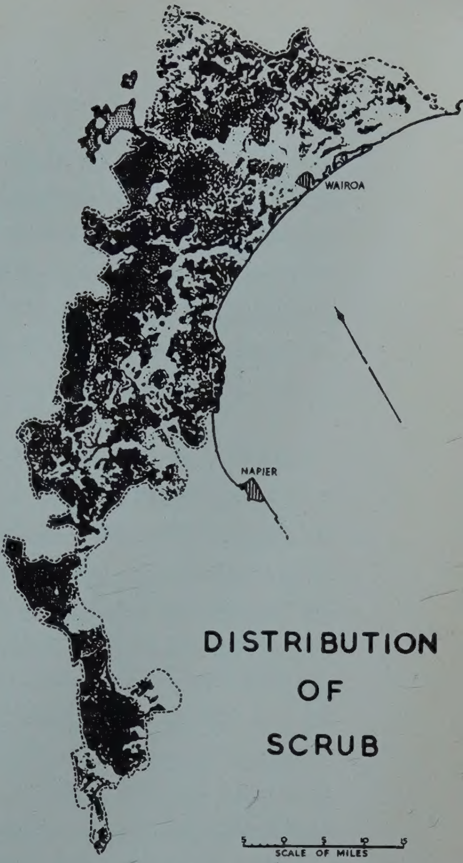

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Fig. 2. Areas shown in black are infested with scrub, dominantly manuka.

impassable in bad weather. Fencing in relation to the size and value of the farm, may be a serious burden. Stock, usually inferior to that raised on land of better quality, has to be watched more closely, or a high percentage of losses must be allowed for. Lambing percentages are likely to be low. Farm workers prefer the easier country and will not face the isolation of the back blocks. The lack of electric power, except for the small amounts produced by home lighting plants, depresses even further the standard of living in the pastoral fringe. Teaching positions are hard to fill, and many farmers have to be content with correspondence schooling for their children, or must reconcile themselves to seeing them at only infrequent intervals when they come home from boarding school. Many of the farmers can seldom take vacations, and few social amenities are available to them. Womenfolk are deprived of social contacts, and are exposed to loneliness, responsibility, and worry unknown to a housewife in the town.

Disadvantages such as these are compensated in the farmer's mind by the hope that, with development, his land and produce will be little inferior to that of farms in the more favoured areas, but at the cost more of labour than of capital. It is significant that most of the farmers in the region are young, and so the prospect of years of hard work and financial sacrifice does not deter them.

The Pastoral Economy

Farming in the pastoral fringe has numerous distinguishing characteristics. Because of the difficulties of farming land with many inherent disadvantages most of the farms are large. Except along the Wairoa coast, very few farms within the region are less than 700 acres in extent. Farms run by one or two men, found on the better, more accessible land, range in size from 1000 to 2000 acres. Large sheep stations, the original land-holding unit throughout the region, still exist as successful and efficient units particularly on the poorer type of land, but are now much reduced in size. They are usually older than the smaller farms and are conceived on a grander scale. Their acreages range from about 2000 to 20,000, although only four reach this maximum figure.

Sheep farming, producing wool, store sheep, and a proportion of fat stock which varies with the quality of land and management, combined with raising beef cattle, is overwhelmingly dominant. Dairying is increasing on the rolling pumice land, especially north of Tutira; it is already well established on the coastal lowlands between Mohaka and Nuhaka. There is a butter factory at Wairoa and a small cheese factory at Nuhaka. The tendency to run more beef cattle in order to control pastures and to build up fertility is growing. Stock densities vary greatly throughout the region, influenced by the quality of pastures, climate, and management variations, but a typical farm would carry a little less than one breeding ewe to every acre of cleared land, as well as dry sheep, and a proportion of about one cattle beast to seven sheep. The dependence upon superphosphate to improve pasture growth is increasing, and the old danthonia swards are giving way in the more favoured areas to pastures in which there is a high proportion of ryegrass and clovers. Such pastures have to be constantly topdressed if they are to retain these more demanding plants. Mechanisation, notably on farms with an appreciable proportion of cultivable land, is now widespread, and most farms have at least one tractor, usually of the crawler type, and a small range of heavy implements. Dependence upon outside labour for fencing, shearing, scrub cutting, pasture establishment and, recently, aerial topdressing is characteristic. Although the region is still characterised by large areas of wasteland overrun with manuka, it is at present passing through a phase of phenomenal development. Scrub is receding and pastures are being created, replaced and improved on nearly every farm. This development is limited only by the dearth of labour and, to a lesser extent, by shortage of capital.

The Financial Problem

The financial problems of pastoral-fringe farmers lie at the root of their other troubles, even though steps have been taken in the past by the government to grant tax concessions. Most of the better-developed, long-established farms benefit materially by the existing tax concessions for farm development, as money which might otherwise be spent is reinvested to avoid excessive taxation. Farmers on the newer, less well-developed country, however, feel that money which should be invested in farm improvements, or held in reserve, is dissipated in taxation. Greater relief to farmers breaking in new country or improving run-down farms would not be a noticeable loss to government revenue at present, and in the future would produce greater tax returns from much improved land.

The financial problems of farmers in poorer areas received the attention of a Royal Commission in 1949.[4] The recommendation that a Marginal Lands Board be set up has been put into effect, but unfortunately, the result in this region has been almost negligible. In 1953, most farmers were still unaware of its existence. Further, the policies of the existing board do not seem designed to produce the best results. Interest rates are too high, and the methods of selection seem to be too severe.

The board will lend money to farmers on marginal land[5] only after they have exhausted all other possibilities of obtaining capital. More general good would be done if loans were made available at very small interest, or at no interest at all if the situation warranted it, to farmers owning undeveloped country who could develop their land into profitable pasture, but who are unable from their existing resources to improve all the land they own. Many farmers are not prepared to

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[4] 'Report of the Royal Commission on the Sheep-Farming Industry in New Zealand', *Append. Journ. House of Repres.*, Vol. IV, 1949.

[5] Marginal land is defined as 'those lands which over a long period of years would yield sufficient production to constitute an economic gain to the nation if developed, but from which the return in a short period would not be sufficient to enable the individual farmer to carry out development.' *ibid.*, p. 53.

Fig. 3. The pastoral fringe between Waikaremoana and the Mohaka River.

commit themselves to large development programmes, using capital on which high interest must be paid, only to put themselves in a higher income-tax bracket. Loans to farmers for raising the productive area of their farms would have the advantage of better security based on the existing area of farmland in profitable operation.

MANUKA BLIGHT

In the past, one of the most expensive tasks has been the cutting of large areas of manuka scrub which had encroached upon pasture (*Fig.* 2). To-day, however, manuka blight has become so firmly established that the need for capital to replace dying manuka with new pasture is becoming urgent. To make this capital available could be the most useful function of the Marginal Lands Board. Failure to do this will be attended by disastrous extension of the area affected by accelerated erosion and by the establishment of undesirable weeds, notably blackberry and gorse, in many areas now under manuka. The manuka blight[6] was first introduced into the region in 1945 and in the original areas the stage is only now being reached when new pastures are being created. As sunlight penetrates the weakened scrub repressed grasses can regenerate. The land is aerially topdressed, oversown with clover, and stocked preferably with cattle, so that the blackened sticks are knocked over and left to rot. The manuka takes two or three years to die even after the presence of the blight is obvious, and the natural rate of spread is sufficiently slow to allow some preventative measures to be taken to protect surfaces on which pasture is an insufficient means of preventing serious soil erosion. The experience of farmers so far has been that after the blight is first introduced, six to eight years pass before the action of the blight is sufficiently advanced to eradicate manuka over an area large enough for pasture development. Unless it is spread intentionally, the blight will take about three years after the initial introduction in one place to spread over a 1000-acre farm.

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[6] The blight is caused by the action of a small sucking insect which feeds on the sap of the manuka and which secretes large quantities of a clear sticky substance known as 'honey dew'. A black sooty mould forms on this secretion. The combination of sap loss and mould slowly kills the plant.

The Farmers' Attitude

While the fears of the New Zealand Forest Service and other bodies concerned with forests and soil conservation as to the effects of manuka blight are well founded, the fact must be faced that as long as there is no known way of preventing its spread, manuka blight will eventually infect manuka throughout the region and will spread out on to unfarmed country. Hitherto there has been little evidence that this fact is being faced. Publicity given to the blight has so far tended to be destructive and of a nature which will antagonise farmers. Appeals not to use the blight are quite useless. There is scarcely one farmer in the whole region who will not only welcome the blight on his land, but will actually encourage it. Even prohibitive legislation would probably be futile. Understandable enthusiasm for the efficient way in which the blight will destroy his most persistent and expensive nuisance overrides any thought of its adverse effect on forest regeneration and soil erosion outside farmed areas. Measures to prevent the use of manuka blight should, to be effective, have been taken before its capabilities became generally known. All that can be done now is to take steps to see that the undesirable effects of the blight are minimised as far as possible. The sooner suitable methods are devised and put into operation, the more effective they will be.

The blight is established in an area between Wairoa, Te Reinga, Waikaremoana, the Mohaka River and Kotemaori. To the south is another smaller area around Tangoio, Arapawanui and Tutira (*Figs.* 1 and 2). There is no evidence in the region of manuka blight attacking other plants. Kanuka (*Leptospermum ericoides*) is infected by a similar blight, but seldom fatally, and in some areas it may be seen flourishing in the midst of dying manuka.

Blackberry (*Rubus fruticosus*) has established itself throughout the region, especially at Tangoio and Arapawanui, and in the Maori areas along the coast between Mohaka and Nuhaka. Nearly every farm has some blackberry, and on many it is the worst pest. Goats are kept to control it. It is probable that the sheep country between Tangoio and Tutira would have been abandoned by now if goats had not checked the weed to some extent. Today goats and blackberry are still significant features in the landscape, although the application of hormone spray has proved a much more efficient method of extermination. Spray obviates the necessity for keeping goats, themselves something of a pest.

Gorse (*Ulex europaeus*) is present within the region in small quantities. It is restricted to a small area just south of the mouth of the Mohaka River, to a few places along the Napier-Taupo road, and near Tangoio. This pest needs to be exterminated now while the task is still easy, and before it is given a chance to overrun areas at present occupied by manuka.

The presence of weeds is one of the main problems of farming in the region. Some native weeds have been encouraged by man-induced changes in vegetation, while others such as thistles have been imported accidentally. Some species, such as ratstail (*Sporobolus capensis*), deliberately introduced originally, are now classed as weeds.

Animal Pests

The worst animal pests are rabbits, opossums and goats. Rabbits, which got completely out of hand during and immediately after the second World War, are now better controlled, and this improvement has been one of the most encouraging features of postwar farming in the pastoral fringe. Rabbit densities are now sufficiently low over most of the region to have virtually no effect on farming practices. Only in a few areas in the southern half of the region do they remain a problem. The potential menace of rabbit infestation remains nevertheless, and constant extermination by rabbit boards, preferably operating on the 'killer' system rather than merely supervising control by individual farmers, is essential. Opossums and goats are, however, increasing. The planting of trees for shelter, timber and soil conservation is seriously hampered by their depredations. Opossums are confined mainly to the northern half of the region, while goats are found in large numbers wherever there is blackberry. In the areas where this weed is particularly troublesome, goats perform a useful function; elsewhere, while

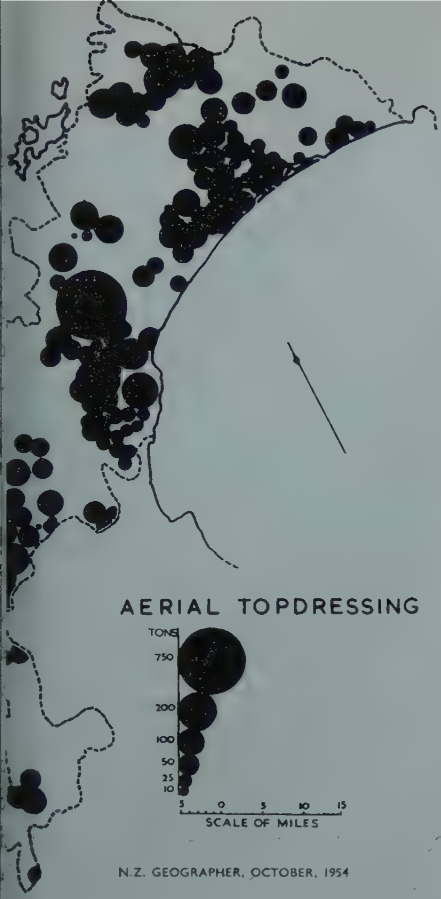

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Fig. 4. Aerial topdressing by localities, 1952.

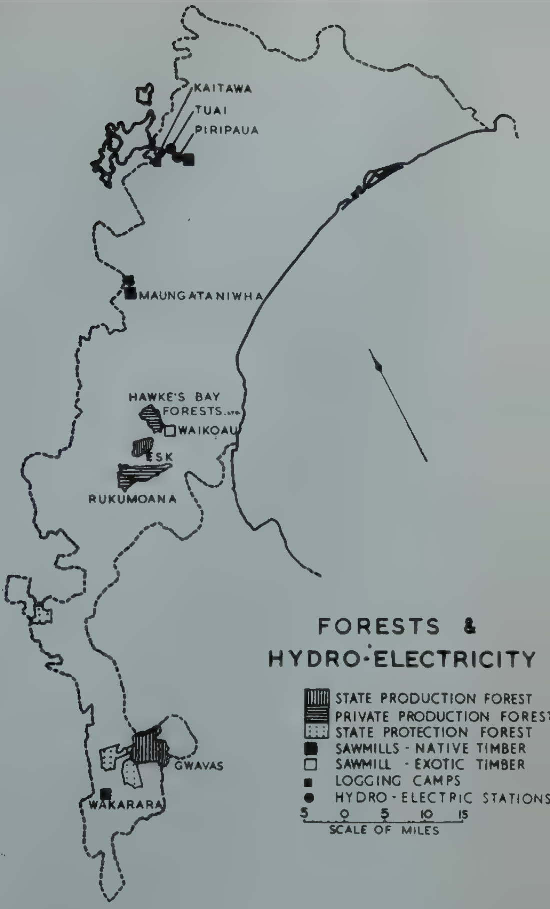

Fig. 5. Forests, sawmills, logging camps and power stations.

their usefulness is recognized, little attempt is made at any sort of control. The incidental commercial value of these three animal pests has in the past militated against their destruction, but it is now more generally realised that a determined programme of extermination has become essential if pastures are to be maintained, forests established and soil erosion checked.

SOIL EROSION

It is dangerous throughout most of the region to disturb vegetation to the extent of exposing the soil. Light soil, soft rock, steep slopes and high rainfall combine to make the hazard of accelerated erosion very great. Wind erosion, slips and slumps, sheet erosion, gullying and underrunners all appear within the region with varying severity. The lowlands are liable to inundation and silt deposition from floods originating in the hill country.

Except on land which has been severely eroded in the past the general attitude of farmers to soil erosion is unresponsive. Within an area on each side of the Esk Valley and north to the Moeangiangi River, over one-tenth of the surface was washed away in two days in April 1938, providing some of the worst erosion-scarred landscapes ever seen in New Zealand.[7] An area just north of the Mohaka River, inland from Waihua, is another badly eroded area (*Fig.* 3), while the extreme western margin of the region, where grazing has extended in some places on to land of doubtful suitability, provides other examples of obvious spectacular erosion. On these lands, farmers do, for the most part, appreciate the danger. In the rest of the region, although slipping is very noticeable, soil erosion is not considered by farmers to be a problem comparable with manuka, blackberry, or rabbits. Warnings from catchment boards and the Soil Conservation and Rivers Control Council have not had much effect on opinions such as these. In 1949 a responsible and expensive Royal Commission decided that soil erosion is not 'a major cause of deterioration'.[8] How opinions such as this are held, in direct contradiction to visible evidence and to the example of overseas experiences, can be explained in part by the attitudes engendered by some of the more startling and sensational publicity given to the problem of soil erosion in this country.

SOME MISCONCEPTIONS

A misconception widespread among the farmers in the region is that the control of soil erosion is likely to be expensive for them, individually. This is, as far as farming within the pastoral fringe is concerned, quite misleading. Sound, profitable farming practices, combined with tree-planting programmes well within the reach of most farmers, is all that is usually required. The effect should be to increase profit rather than to reduce it. Higher, and certainly more sustained production would be the ultimate result. The widespread idea that conservationists believe that large areas now in farmland should be abandoned is another misconception. While there is some land within the region which could more profitably be planted with trees, this idea cannot be applied indiscriminately, for the notion that their farms are decreasing in value is naturally unpalatable to farmers. Soil conservation practices to be widely adopted must be reconciled with good farming techniques, and publicity in the future should stress this compatability. The results of experiments made on similar country outside the region at Gisborne,[9] and at the Tangoio experimental farm within the region, indicate that the ultimate prospects for control are good.

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[7] See K. B. Cumberland: *Soil Erosion in New Zealand,* Wellington, 1944, pp. 57-58, and A. P. Grant: 'Hawke's Bay Flood, April 1938', *Proc. N.Z. Inst. Eng.,* Vol. 25, 1938-1939.

[8] Royal Commission Report, *op. cit.,* p. 62.

Aerial Topdressing and Forests

Two factors operating within the region today will have a beneficial effect upon soil conservation—aerial topdressing and the increased planting of exotic timber trees. Aerial topdressing, first adopted within the region in 1949, has become the principal method of fertiliser application (*Fig.* 4). To put phosphate on much of the more rugged land was previously impossible, but now, whenever an airstrip can be constructed, superphosphate can be applied. The cost compares favourably with other methods, and it is far less trouble to the farmer himself. The tonnage applied is increasing every year, but it is still far from adequate. Nevertheless the results are fourfold: denser swards in which there is a larger proportion of demanding grasses and clovers have been encouraged, carrying capacities have been raised, cobalt deficiencies have been counteracted, and soil erosion has decreased. Approximately one third of the total area of the fringe now receives regular aerial topdressing.

Severe wind erosion, which blew the pumiceous topsoil off a large area of Rukumoana station (*Fig.* 6), one of the better known sheep stations of the early days, prompted the planting of insignis pine (*Pinus radiata*) as commercial forest in 1933, and other pine forests have been created within the region since. The New Zealand Forest Service operates two production forests already, at Gwavas and Te Pohue (*Fig.* 5), and two more in northern Hawkes Bay and Wairoa are projected. The forests have grown well, and logging has already begun at Rukumoana and at another privately owned forest at Waikoau. It will become necessary to plant large areas in exotic pines as manuka on land unsuitable for pastures becomes infected with blight. Some of these plantings could be designed for commercial use, but some will need to be sown broadcast in standing manuka within the near future. The combination of farm and forest has proved very successful at Rukumoana, where the pastures act as firebreaks to the forests, which in turn protect the pastures from strong cold winds. The presence of farmland means that interest has been maintained in the associated

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[9] *Down to the Sea in Slips:* Soil Conservation and Rivers Control Bulletin No. 5.

Fig. 6. Farm and forest at Rukumoana.

forests, and in this way the tendency to neglect the trees when the initial enthusiasm of planting has waned has been avoided. This combination of farming and forestry would help to solve farming difficulties elsewhere in the region. The milling of native timber, never very plentiful in the region, has declined. Small stands occurred at Te Pohue, Puketitiri and Nukaha. Some logging continues along the western edge of the region in the remnants of the original forest there (*Fig.* 5).

EXPERIMENTAL AREAS

The area devoted to forest is small compared with that used for other specialised purposes. Experimental areas are a feature of the pastoral fringe. The Soil Conservation and Rivers Control Council, in conjunction with the Hawkes Bay Catchment Board and interested government departments, operates an experimental farm near Tangoio. The

Fig. 7. Land development near Patoka.

experiments so far have been concerned with soil erosion, soil conservation and differential pasture growth. Manuka blight and methods of blackberry control are also being observed. Such experimental farms, which share the problems of the surrounding areas, are particularly useful in that they show neighbouring farmers the results which can be achieved by new methods, and allow them to gauge the possible economic advantages. The Tangoio farm was originally taken over in order to control slipping which persistently blocked the Napier-Wairoa main highway. The slopes above the road have been planted in trees, and erosion has been halted. Investigations of a different type are conducted on an experimental farm near Raupunga. The shortage of lowland in relation to hill country in the Wairoa area has meant that much of the stock raised there must be sent away as stores. The company owning the freezing works at Wairoa is conducting experiments, mainly with different types of crops, to test the economic possibilities of increasing the proportion of fat stock available for killing at Wairoa.

DEVELOPMENT AREAS

There are fourteen development schemes for the settlement of returned servicemen in the region (*Fig.* 8). Large farms and sheep stations, usually in poor condition, were acquired by the government, developed to a state of high productivity, and subdivided for settlement. The establishment of these schemes, which have all been successful, has meant that large areas have now been put down into first-class pasture and many excellent little farms created. This example of achievement by vigorous methods has not been lost on the ordinary farmer. A rapid rate of development is now one of the region's main characteristics. A similar type of scheme has been in operation on Maori land at Raupunga, Waihua and Mohaka. The object is to develop the land and to subdivide it into economic units to be farmed by individual Maori settlers. The project has had considerable success, although the Maori sometimes has difficulty in adapting himself to a system of commercial farming, and development of this nature needs very careful planning and administration. It is best left in the hands of Maori officials, as is the case here. The Maori population in the region is concentrated in the Wairoa area in nucleated settlements, particularly on the lowlands. Finally, mention must be made of the specialised form of development typified by the three hydroelectric power stations which utilise the fall from Lake Waikaremoana (*Fig.* 5).

INHERITED CHARACTERISTICS

The geography of the pastoral fringe in Hawkes Bay is being influenced more and more by the modern trends operating in the region, but they have not yet altered its whole character. To the eye, much of the land seems very poor. Manuka scrub covers large areas; traces of the period of forest exploitation are still apparent where pastures are strewn with stumps and charred standing trunks; and deserted mills with their untidy piles of scrap metal, tumbledown shacks and heaps of rotting sawdust are occasionally found. The land has not wholly recovered from the years when fertility declined, rabbits overran the pastures, soil erosion scarred the slopes, and weeds increased unchecked. Usually only a part of each farm is in production or benefits from the latest farming methods. The rest is left in scrub and thin weedy pasture until the farmer can afford to develop it. The Maori farms may be used to support a small dairy herd and to grow a patch of maize, but frequently, instead, they are overrun with blackberry and ragwort (*Senecio jacobaea*). Settlements remain very small, with seldom a sign of growth, and no township of appreciable size exists between Napier and Wairoa (*Fig*. 9). Settlements are limited to a school, a general store and, sometimes, a rural carrying business or an hotel. Communications have always been a problem. The railway, only in permanent operation since 1939, has been of great value to the region, although it is very liable to blockage by slips. Roads, including the main highways, are for the most part poor. Floods, washouts and slips are frequent causes of traffic disruption, and bridges are apt to be washed away by sudden spates.

THE REGION AND THE FUTURE

The pastoral fringe of Hawkes Bay, then, is a region of experiment and progress, of backwardness and reversion but of development beyond the stage of a pioneer fringe, although it does retain many pioneer characteristics. Yet the prospects of the region are good. If present trends continue, the region should be transformed within a decade from its present relatively backward condition to one in which farming, while still much less intensive than in better-endowed areas, will be stable and profitable.

It must be appreciated, however, that the development characteristic of the whole region is dependent upon buoyant markets. Present returns from meat and wool allow superphosphate to be applied to

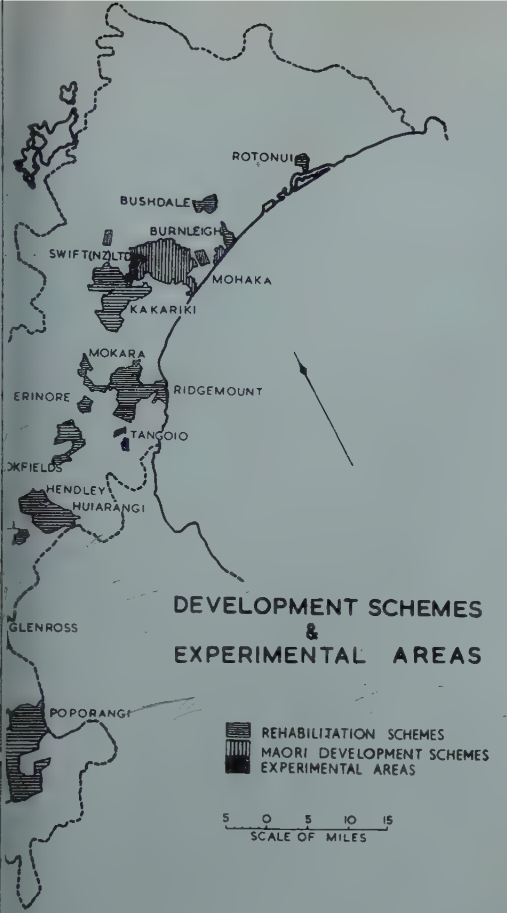


Fig. 8. Experimental and developmental areas.

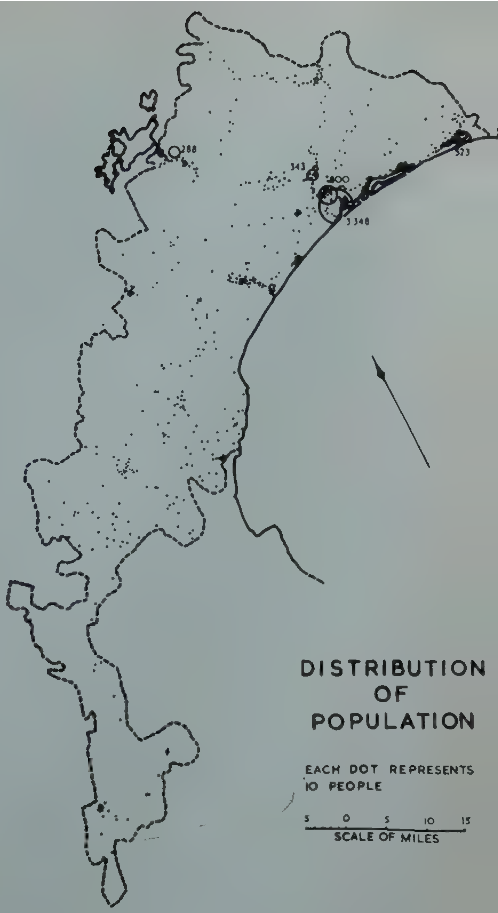


Fig. 9. Distribution of population, 1951.

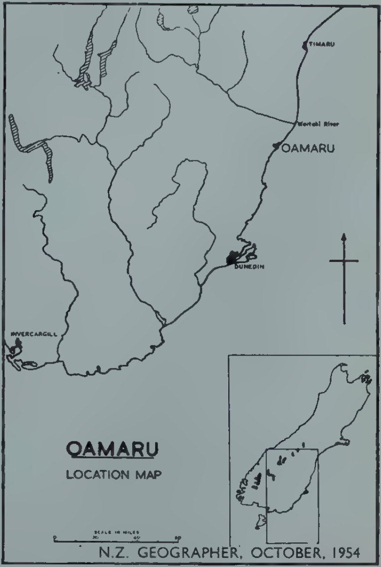
many areas where, if the market slumped, topdressing would be economically impossible. It is certain that heavy applications of superphosphate will always be necessary over the whole region to maintain its production, for even if fertilizer and introduced clovers are building the fertility of the land, fertility would never be more than temporary if superphosphate dressings ceased.

Success in farming within the region is particularly sensitive to extraneous influences. New technology, for example, can provide great improvements. This has happened from time to time in the past, but many opportunities remain. Precise investigations into soil deficiencies and the improvement of grasses and other types of vegetation suitable for poorer country such as this are two fields which are almost untouched. Conversely, a drop in market prices overseas could effectively prevent further development. Yet if the results already achieved experimentally, and on the more progressive farms, were applied to the whole area, production could be raised to many times its present level. Much scope remains for subdivision and further settlement. If production in primary industry is to keep pace with New Zealand's growing population, areas such as the pastoral fringe in Hawkes Bay, in which development has lagged in the past, must in the future be utilised to their fullest extent.

THE OAMARU TRIBUTARY REGION

J. U. MACAULAY

IN A RECENT contribution to methods in geography, Professor Preston E. James made a useful distinction between what he called the 'static' and the 'kinetic' types of region.[1] In New Zealand, regional systems based on patterns of static conditions have usually been referred to as 'geographic' regions,[2] whilst kinetic regions, defined on the basis of patterns of movement at any one period of time, have hitherto been termed — aptly enough — 'tributary regions'.[3]



N.Z. GEOGRAPHER, OCTOBER, 1954

Fig. 1. Location of Oamaru.

One essential objective in discovering the size and nature of a town's tributary region is the location of its boundary. In almost every instance, however, the outer limits of the administrative, social and economic tributary areas of the town are found to vary considerably in size and shape; any attempt to fix a general boundary can be little more than the statistical mean of these various separate limits.

Confronted with this problem, many students have reached a solution by making a subjective estimate. At least one geographer has tried to overcome this difficulty by recognising first a 'core area' whose dependence upon the town is little doubted, and then a 'zone of competition', where there is overlapping in business services and community of interest between towns on either side.[4] This expedient seems to be a happy solution until it is realised that, to demarcate the 'zone of competition', twice as many boundaries must be discovered. Moreover, the area of the 'zone of competition' often becomes greater than that of the core area itself.

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[1] Preston E. James: 'Toward a Further Understanding of the Regional Concept', *Annals Assoc. Amer. Geogrs.*, Vol. 42, No. 3, September 1952, p. 200.

[2] K. B. Cumberland: 'The Nature of Regional Geography', *Post-Primary School Bulletin*, Vol. 4, No. 8, 1950.

[3] L. L. Pownall: 'Town and Region: A Comparison of Palmerston North, Wanganui and New Plymouth', *N.Z. Geographer*, Vol. 9, No. 1, April 1953, pp. 1-16.

[4] G. F. Deasy: 'Sales and Service Industries in Luce County, Michigan', *Economic Geography*, Vol. 26, No. 4, October 1950, pp. 315-324.

Another common, but questionable, practice is for enquiries about the limits of tributary areas to be restricted to the townspeople and to omit consulting the inhabitants of what appear to be zones of overlap. Undue dependence should not be placed upon the opinions of business executives as the limits they suggest are sometimes quite unintentionally overoptimistic. In a recent study of the tributary region of Oamaru, a small but typical regional centre in the South Island of New Zealand, a more objective technique was developed which proved successful and which might provide other workers with a 'theoretical' basis for further investigations of this problem. This new technique is explained below.

THE MARKET TOWN OF OAMARU

Situated on the east coast of the South Island of New Zealand, Oamaru is favoured by its location on the main rail and road routes seventy-eight miles from Dunedin, the nearest large city (*Fig.* 1). With its small artificial harbour, large railway yards, ample wool, grain and small-seeds stores, and numerous offices, shops and factories, Oamaru is the regional centre for what is generally called the North Otago district. The total population of the borough and adjoining residential areas was estimated in 1951 as 9200.[5] Timaru, fifty-two miles to the north, has more than twice, and Dunedin nearly ten times this population.

An analysis of some official statistics shows that, in terms of numbers employed, commerce is the leading economic function of Oamaru.[6] The headquarters of most firms engaged in commercial activities in North Otago are concentrated in the town.[7]

LAND TRANSPORT NETWORK AND TRAFFIC FLOW

The first step in fixing the boundary of a tributary region is to survey local transport facilities as links between the town and its hinterland. In the case of Oamaru, this study disclosed some limitations which reduce the number of districts which are conveniently accessible to the town.

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[5] This is based on preliminary figures from the 1951 census.

[6] On 15 October 1949 the estimated total of employed persons in the town was 3160. The estimated percentage employed in each of the main occupational groups was: commerce thirty-six, industry twenty-seven, transport and communications seventeen, administration thirteen, health services seven.

[7] The district controlled by the Oamaru office of the Department of Labour and Employment includes Waitaki County and the Boroughs of Oamaru and Hampden. On 31 March 1950, 98 of the 104 commercial offices and 216 of the 287 shops in this district were located in Oamaru.

The reticulate road pattern and the 'goods feeder' branches of the main trunk railway, which both extend inland to serve the mixed farming districts of the South Island, stand in marked contrast to the loose mesh of roads extending out to the scattered sheep stations, power stations and tourist resorts of the High Country. This difference stands out clearly in Figure 2. Moreover, the close relationship which often exists between transport facilities and surface configuration is revealed by even a cursory comparison of Figures 2 and 3.

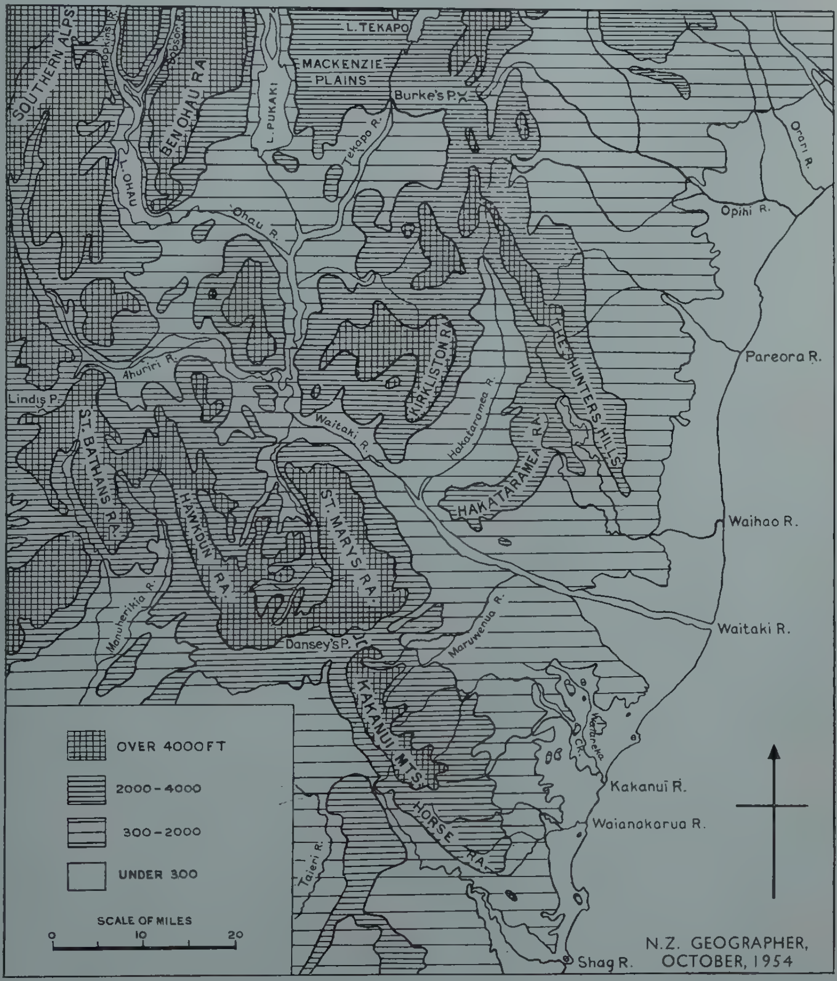
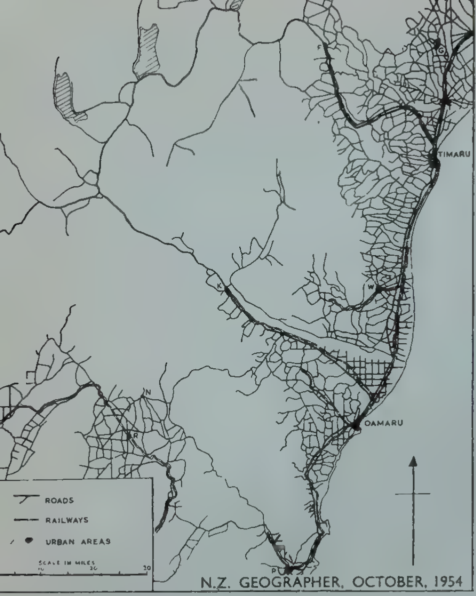


Fig. 2. Surface configuration in the Oamaru region.

To the southwest and west of Oamaru the continuous chain of highlands, which stretches from the Southern Alps to the sea at Shag



ig. 3. Pattern of road and railway.

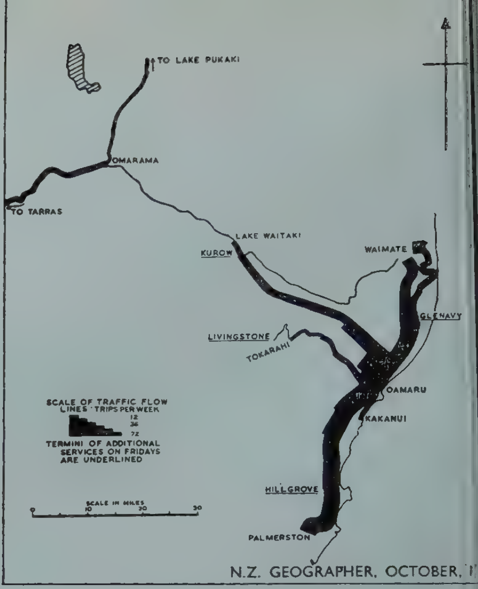


Fig. 4. Frequency of road services.

Point, is a formidable barrier. Along this major water divide only the Horse Range at the coastal end and two passes further inland have an elevation of less than four thousand feet. The main railway and road skirt the seaward end of the Horse Range, which is crossed only by the old coach road. An all-weather road crosses the Lindis Pass, while the clay road across Danseys Pass has but a limited value as a connection between the Oamaru district and the Maniototo Basin. Most traffic for Ranfurly uses the roundabout way via Palmerston and the 'Pig Root'.

The piedmont plain and downlands of eastern South Island are crossed by several rivers, each of which has such a wide sprawling course that, owing to the high costs, only a minimum number of bridges has been erected. In many respects, such obstacles as the braided channels of the Rakaia, Rangitata and Waitaki Rivers thus provide definite boundaries for the tributary regions of adjacent towns. Only two bridges have been built across the Waitaki River which enters the sea north of Oamaru. They are thirty-five miles apart, at Glenavy and at Kurow, and both are famed for their rickety decking. Unfortunately the more important Glenavy bridge has become a serious bottleneck, as it serves both trains and road vehicles (*Fig.* 5).

One district north of the Waitaki River, however, has close associations with Oamaru itself, namely the Hakataramea Valley, with its railhead at Kurow on the south bank. This fertile valley, which is nearly thirty-five miles long, is almost encircled by highlands and is not densely populated; it has only one all-weather road outlet. This is connected with Kurow by the bridge already mentioned and is thus intimately though indirectly linked with Oamaru.

A map showing the weekly frequency of bus services helps to illustrate several aspects of the local movement of people. The importance of Oamaru as the regional focus for several services, many of which are concentrated along the main north-south highway, is shown in Figure 4. Lake Waitaki and Tokarahi are the terminals for the two daily inland services. The greater flow across the Upper Waitaki, rather than down the valley from Omarama to Kurow, is the result of services between tourist and holiday centres to the north and south.

Such a survey as this of the land transport network and traffic flow is a necessary contribution to the demarcation of a tributary region. It illustrates the point that mountain ranges and sometimes rivers often effectively limit the extent of the rural area easily reached from nearby regional centres.[8]

LOCAL ADMINISTRATION

Usually the next stage in delimiting the region tributary to a town is to discover the extent of the various administrative, social and economic tributary areas by arranging interviews with government officials and business executives and by consulting official proclamations. Subsequently a series of maps can be compiled and a comparison of boundaries made on the basis of the data so obtained.

In New Zealand, county boundaries are the most significant limits of administrative districts because, after the abolition of Provincial Councils in 1876, they were the first to be demarcated and have since been partly or wholly adopted by many other local administrative,

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[8] L. L. Pownall: 'Feilding: A Rural Township and Its Region', *N.Z. Geographer,* Vol. 3, No. 2, October 1947, p. 170.

Fig. 5. The combined road and railway bridge across the Waitaki River.

commercial and social organisations. The northern and eastern boundary of Waitaki County[9] corresponds approximately with that separating the former provinces of Otago and Canterbury and the present land districts with the same names (*Fig.* 6).[10] To the west and south the county boundary follows the crestline of the highland chain which extends from the Southern Alps to the sea at Shag Point.[11] The county boundary thus includes that half of the Waitaki River catchment on the same side of the river as Oamaru and within easy access of the town.

There has been a tendency, however, for some of the larger counties in New Zealand to be subdivided into smaller units. In many districts today their limits prove a less satisfactory indicator of probable tributary regions than the boundaries of *ad hoc* authorities with a more specialised function. Thus the Waitaki Electric Power District[12] and the Oamaru Harbour District[13] both embrace the Hakataramea Valley which is a part of Waimate County. The Waitaki Hospital District[14] virtually includes the valley because the South Canterbury Hospital Board helps to maintain the Kurow Maternity Hospital, thus recognising its value to the valley folk. The Glenavy-Morven district, south of the Waihao River, exports large quantities of farm produce, especially cereals, via the port of Oamaru; it has always been part of the Oamaru Harbour District.

Some government departments have largely ignored county boundaries in their division of both islands into districts to suit their special purposes. Because convenience of access and community of interest have been their main criteria, their choice becomes all the more significant. Figure 7 shows that the Post and Telegraph, Police and Agriculture Departments include the Hakataramea Valley with most of Waitaki County in the districts administered from their Oamaru offices.

NEWSPAPER CIRCULATION

The extent of local newspaper circulation often indicates the limits of areas with a community of interest. Unfortunately the one local paper in the Oamaru district, the *Oamaru Mail*, comes off the press in the late afternoon and can be delivered the same evening only to

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[9] Boundaries defined in the *N.Z. Gazette*, 1876, p. 825, and *ibid.*, 1924, p. 32.

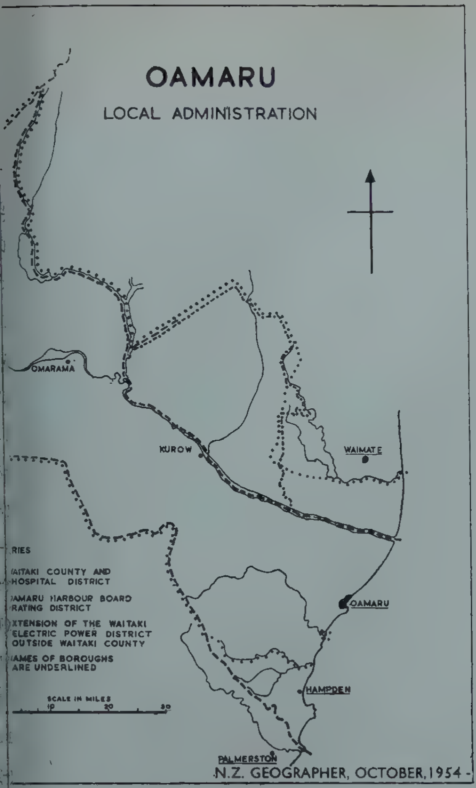
[10] The boundary runs from the main divide of the Southern Alps down the Hopkins River, along the eastern shore of Lake Ohau to the Ohau River, thence down this river to its junction with the Waitaki, which it follows to the sea.

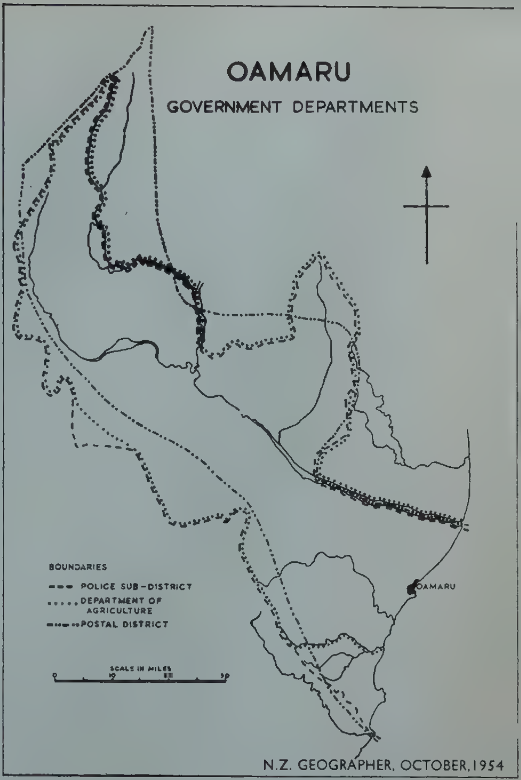
[11] Except for the inclusion of a small area at the headwaters of the Manuherikia River.

[12] Boundaries defined in the *N.Z. Gazette*, 1923, p. 2187.

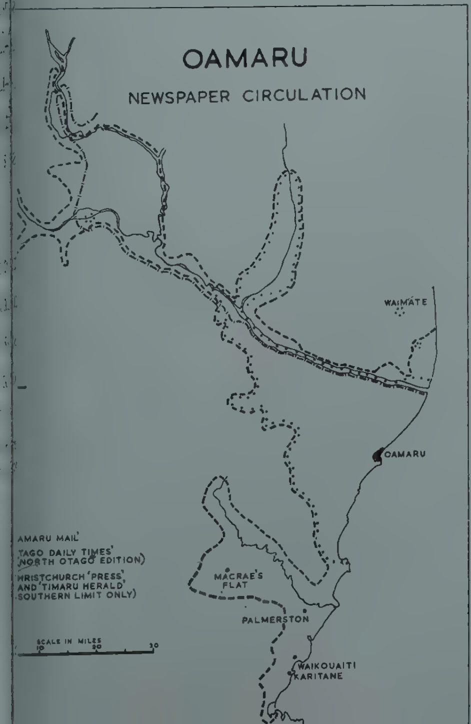
[13] Boundaries defined in the *N.Z. Gazette*, 1882, p. 1746.

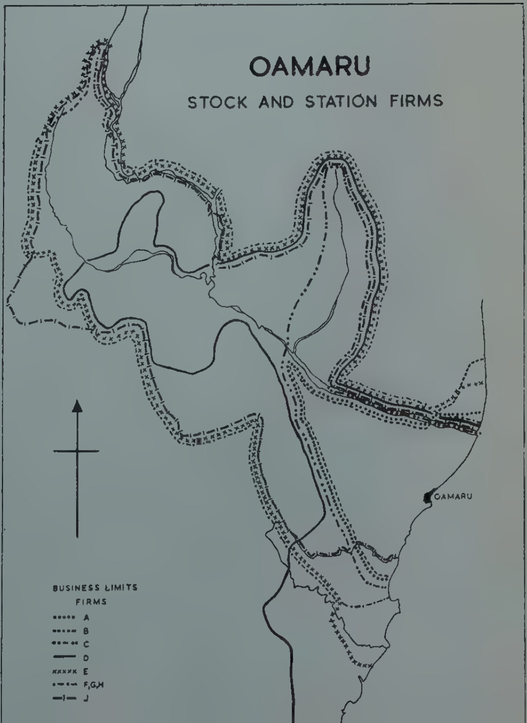
[14] Boundaries defined in the First Schedule of the Hospitals Act, 1926.


OAMARU
LOCAL ADMINISTRATION
OMARAMA
KUROW
WAIMATE
OAMARU
HAMPDEN
PALMERSTON
RIES
AITAKI COUNTY AND HOSPITAL DISTRICT
AMARU HARBOUR BOARD RATING DISTRICT
XTENSION OF THE WAITAKI ELECTRIC POWER DISTRICT OUTSIDE WAITAKI COUNTY
AMES OF BOROUGHS ARE UNDERLINED
SCALE IN MILES
10
20
30
N.Z. GEOGRAPHER, OCTOBER, 1954



Figs. 6, 7, 8 and 9. Functional boundaries of Oamaru: local and governmental administration, newspaper circulation, and farming interests.





subscribers in urban areas or to those who live close to bus routes with late afternoon and evening services. The following morning it reaches the less accessible districts; only twice a week can it be sent to the Upper Waitaki Valley (*Fig.* 8). Moreover, buses from Timaru bring the *Timaru Herald* and the Christchurch *Press*,, both morning papers, to the Upper Waitaki runholders three days each week.

A more reliable guide to local community of interest is, however, disclosed by the circulation area of the North Otago edition of the *Otago Daily Times*, a Dunedin morning paper, which is delivered on the day of issue to many country places via an Oamaru distribution office.[15]

TRIBUTARY ECONOMIC AREAS

The highly commercialised nature of New Zealand farming has assisted the wide ramifications of stock and station agencies. Farmers are continually in touch with stock firms, either through field representatives' visits or by personal office calls. As the larger concerns have offices or agents in nearly every town the limits of branch business areas which they adopt have a considerable influence upon the town most frequently visited by farmers in a particular locality.

There are nine stock and station agencies with offices in Oamaru. Five of these are local firms while the rest are branches of larger and more influential concerns. The boundaries of districts in which the firms have regular business dealings with the farmers are shown in Figure 9. Three local agents (firms A, B and C) handle mainly agricultural produce and their business areas are restricted almost entirely to the mixed farming districts. The fourth local firm (D), the agent for several manufacturers of farm machinery, and the fifth (E) have wider fields of business.

It is, however, the extent of the Oamaru branch territory of firms (F, G, H and J) which have other branch offices to the north in Waimate or Timaru and to the south in Palmerston or Dunedin which makes a more important contribution to the demarcation of the tributary region of Oamaru. It is worth noting that these branch offices serve and administer an almost identical business area: the Hakataramea Valley and the whole of Waitaki County save the Katiki-Shag Point

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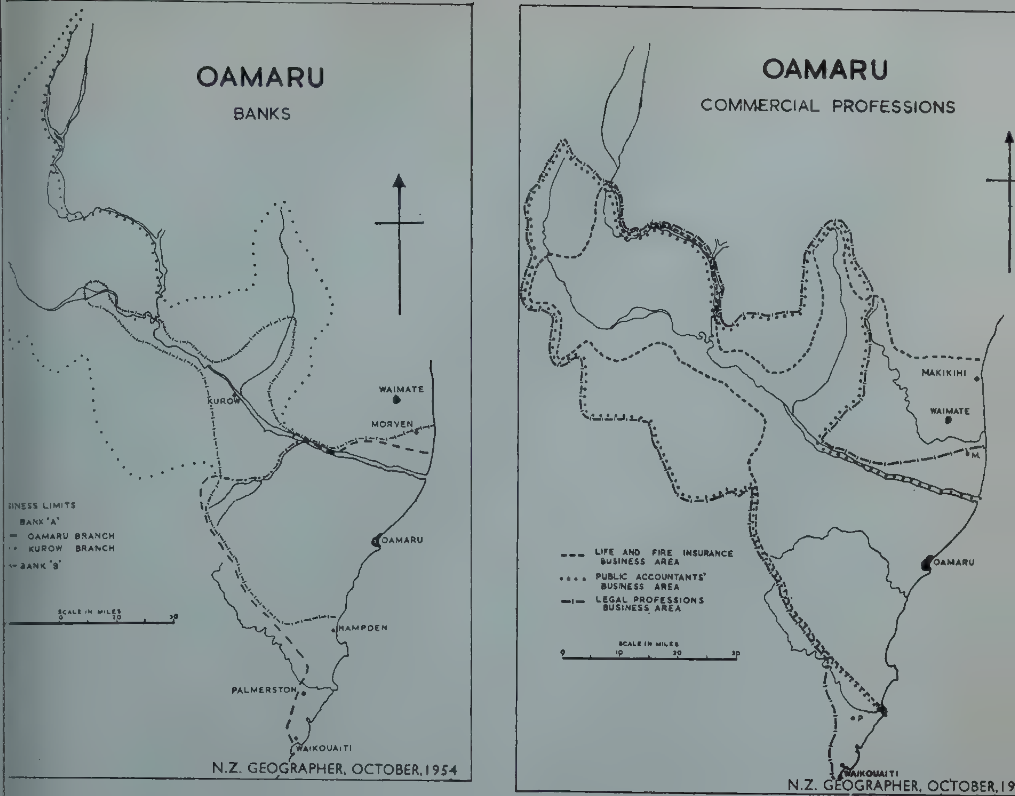
[15] The distribution of the same edition in the Seacliff, Waikouaiti and Palmerston districts is a reflection of ease in delivery by the same northbound bus rather than an expression of community of interest.



Figs. 10 and 11. Areas served by bankers, insurance agents, accountants, lawyers and solicitors resident in Oamaru.

district in the south. All four have chosen the lower Waitaki River as a convenient northeastern boundary.

The spheres of activity of such other types of business as banking, commercial law, insurance and public accountancy all afford further evidence. Except for minor differences in coastal localities to the north and south, the tributary areas of these commercial professions were found to be much the same as that just described (*Figs.* 10 and 11). Oamaru has five banks; Kurow has one.[16]

Most New Zealand farmers and their wives consider a weekly visit to their nearest shopping centre obligatory. Thus Smailes' reference to English conditions—'it is as centres of retail distribution, as shopping centres, that the residents of a surrounding district have most frequent and intimate association with the town centre'—has a wide application in New Zealand also.[17] The general limits of a town's retail business area are disclosed by the extent of both centripetal and centrifugal movements. The periphery of districts whose inhabitants regularly visit a particular shopping centre represents the former; it partly manifests itself in the termini of additional bus services on the weekly late shopping night. The outer boundary of rural mailcar services based on the town helps to express the latter.

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[16] Figure 11 shows the business areas of banks A and B. The former, besides having branches in both Oamaru and Kurow, handles most of the district's business transactions. The latter is the only bank with branches in both Waimate and Palmerston.

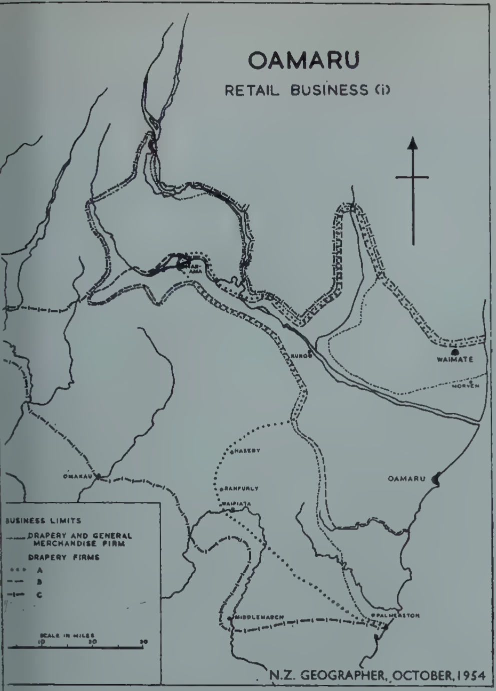
[17] A. E. Smailes: 'The Analysis and Delimitation of Urban Fields', *Geography*, Vol. 32, Part 4, December 1947, p. 155.

In North Otago, twice-weekly shopping trips are customary, one on stock-sale day, Tuesday, and the other on Friday, late-shopping night. This practice has resulted from the town's early dominance in local retail business and from the increased and extensive use of motor transport. The Friday night bus termini at Glenavy, Kurow, Livingstone and Hillgrove are shown in Figure 4 and the outer boundary of mailcar services in Figure 14. The latter includes most farmsteads in the Upper Waitaki and Hakataramea Valleys and the mixed farming area from the Waitaki River as far south as Big Kuri Creek on the outskirts of Hampden.

The business areas of some of Oamaru's largest retail firms are shown on Figures 12 and 13. They embrace a wider field than is suggested by the services mentioned above. In many respects the extensions are found to be transitional zones, localities obtaining some goods and services from Oamaru but the bulk from elsewhere. Into this category fall the Palmerston, North Maniototo and Southern Waimate districts, Dunedin being the main business centre for the first two and, for the third, Waimate and Timaru.

The Boundary of the Tributary Region

Once the preparatory work outlined above has been completed, the delineation of a town's tributary region can begin with a comparison of the boundaries shown on the maps of the various individual tributary areas. The first impression, when using this procedure with the Oamaru maps, was the wide variety of boundary positions. A closer examination, however, showed that the presence of encircling highland barriers with their related transport bottlenecks helped to define most of the town's tributary areas within almost similar limits; it made the choice of a general regional boundary a relatively simple matter, except near the coast, where, in the Glenavy-Morven and Hampden-Katiki districts, there is a gradual transition in both community of interest and commercial connections. The tributary region could therefore be recognised, with these localities excepted, as comprising Waitaki County together with the Hakataramea Valley and adjacent slopes on the north bank of the Waitaki River.



2 (above). Areas served by three drapery firms.

elow). Rural mail deliveries from amaru and Kurow.

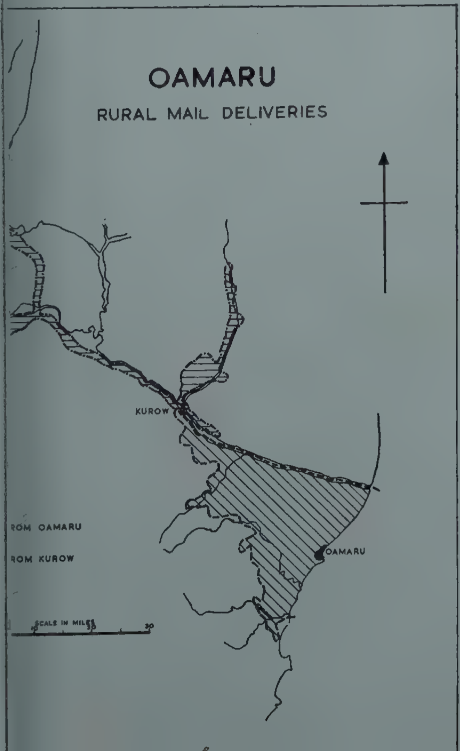
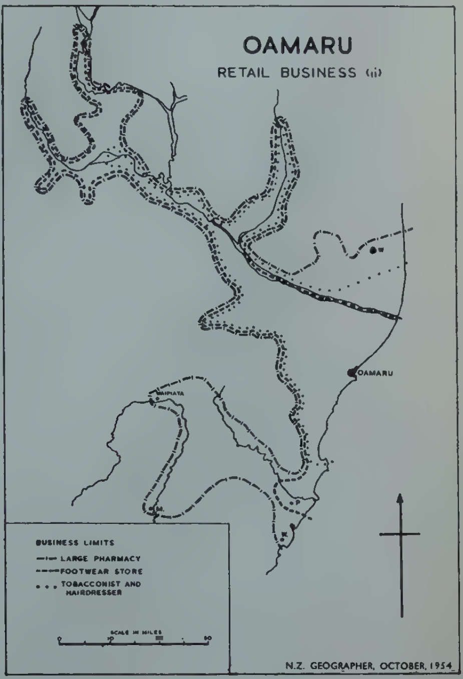


Fig. 13 (below). Areas served by a pharmacy, footwear store and tobacconist.



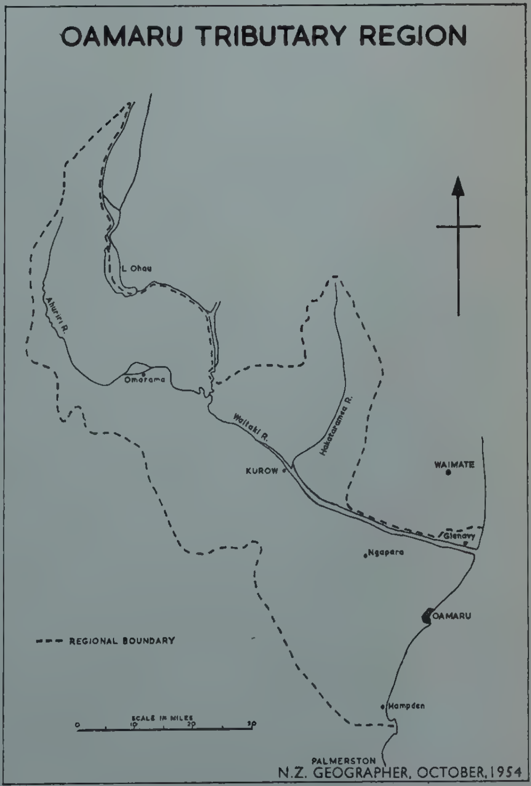


Fig. 15 (above). The Oamaru tributary region.

Within these two transitional zones, the location of a boundary was made less arbitrary by detailed investigation in the field. The

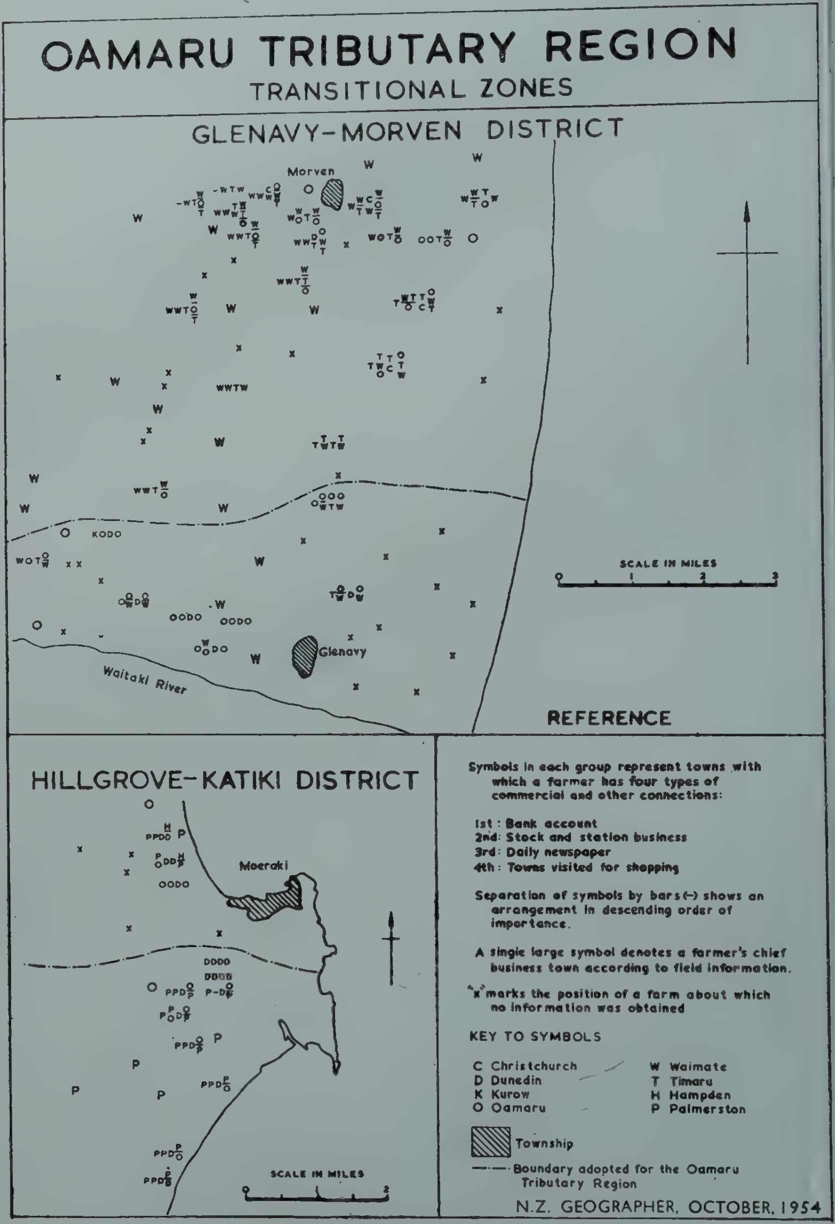

OAMARU TRIBUTARY REGION
TRANSITIONAL ZONES
GLENAVY-MORVEN DISTRICT
Morven
Glenavy
Waitaki River
SCALE IN MILES
0 1 2 3
HILLGROVE-KATIKI DISTRICT
Moeraki
SCALE IN MILES
0 1 2
REFERENCE
Symbols in each group represent towns with which a farmer has four types of commercial and other connections:
1st : Bank account
2nd: Stock and station business
3rd: Daily newspaper
4th : Towns visited for shopping
Separation of symbols by bars (–) shows an arrangement in descending order of importance.
A single large symbol denotes a farmer's chief business town according to field information.
"x" marks the position of a farm about which no information was obtained
KEY TO SYMBOLS
C Christchurch
D Dunedin
K Kurow
O Oamaru
W Waimate
T Timaru
H Hampden
P Palmerston
Township
Boundary adopted for the Oamaru Tributary Region
N.Z. GEOGRAPHER, OCTOBER, 1954

Fig. 16. The delimitation of the region in transitional areas.

information obtained by this fieldwork, which comprised personal visits to a representative and evenly distributed number of farms, is summarised in Figure 16. Each farmer or his wife was asked a uniform set of questions to reveal what business connections the farm family had with nearby towns. The answers were noted and subsequently plotted as a group of symbols on the map.

Once the data had been plotted on the map the choice of the location for the regional boundary became a less subjective decision than it would otherwise have been. From evidence collected in Oamaru before the transitional zone was visited, it seemed as if both the Glenavy and Morven districts formed part of the tributary region of Oamaru; however, the fieldwork described above revealed that the boundary of the region separated the two districts.[18] In the same manner, in the south, the Hillgrove, but not the Katiki district, was found to be part of the region which is shown on Figure 15. These results demonstrated the advantages of the accuracy to be derived from field enquiries conducted in the transitional zones to supplement evidence collected from interviews in the town.

The hinterland generally tributary to many another New Zealand town resembles that surrounding Oamaru. It is often similarly enclosed, for the most part, by sparsely-peopled uplands with transitional zones of relatively dense rural settlement found only along the coastal or valley corridors connecting the lowland pockets on which is situated each city or major town. It is suggested that the trial and adoption, in at least a modified form, of the technique outlined above might be found valuable and rewarding by geographers engaged on similar work.

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[18] In the Morven district the acceptance of Oamaru as the major urban centre appears to be prevented by three factors—stock firms' branch boundaries, lack of a common daily newspaper, and delays associated with the use of the combined road and rail bridge over the Waitaki River.

THE POUTINI COAST: A GEOGRAPHY OF MAORI SETTLEMENT IN WESTLAND*

MURRAY McCASKILL

WESTLAND, lying remote from the points of Polynesian landfall in northern New Zealand and isolated by mountain barriers and a stormy ocean, was probably not visited by stone-age man for some centuries after the first settlement of New Zealand. It is quite probable that the shores of Westland, the first part of New Zealand to be seen by European eyes, were among the last parts of the country to be occupied by Polynesian settlers. When Thomas Brunner visited Westland in 1847-1848 he found only ninety-seven inhabitants on the 220-mile extent of coast from Karamea to Paringa.[1] Despite its small population and remote position, Westland, by its possession of the most highly prized article of Maori trade, the coveted *pounamu* or greenstone, played a special role as a region producing a high-quality mineral for the whole of New Zealand. For several centuries the greenstone traffic took the mineral to every part of the country and contributed markedly to the development of Maori culture and its high standard of artistic skill.

SOURCE MATERIAL

Sources for the study of the Maori geography of Westland in the early nineteenth century are the first-hand observations of early travellers from 1846 onwards: notably Heaphy, Brunner, Rochfort and James Mackay;[2] and the comparatively meagre record of folklore and tradition derived from the natives by European recorders, among them,

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[1] Thomas Brunner: 'Journal of an Expedition to explore the Interior of the Middle Island of New Zealand', *Journ. Roy. Geog. Soc.*, Vol. 20, 1851, p. 361.

[2] Charles Heaphy: 'Notes of an Expedition to Kawatiri and Arahura on the Western Coast of the Middle Island', *Nelson Examiner*, 5, 12, 19, 26 September; 3, 10, 17 October, 1846; Brunner: *op. cit.*, pp. 344-378; John Rochfort: 'Journal of Two Expeditions to the West Coast of the Middle Island of New Zealand in the Year 1859', *Journ. Roy. Geog. Soc.*, Vol. 32, 1862, pp. 294-303; James Mackay: *Draft Report on Purchase of all West Coast from Natives*, 1860 (unpublished MS. in Department of Lands and Survey, Hokitika).

Alexander Mackay, Roberts, Stack, Travers and Mitchell.[3] As a result of the nature of the Maori occupation, fieldwork today is unlikely to be as rewarding to the student of Maori geography in Westland as it may be in the North Island, nor is there any documentary record of excavations of Maori sites.

The Setting

The physical features of the Poutini coast made it one of the least promising environments for stone-age man in New Zealand. Along the 300-mile stretch of harbourless coast, bold cliffs alternated with sand beaches on which the surf pounded incessantly and swept up great piles of driftwood. Inland, the region was bounded for most of its length by the snow-crested Southern Alps and in the northeast by the confused tangle of mountains and gorges of northwest Nelson. Ten miles west of the main divide, where the mountain spurs terminate abruptly at the great Alpine Fault, lay the varied terrain of the Westland lowlands. Isolated granite mountains, smooth ridges of glacial moraine, suites of flat-topped outwash terraces, undulating hills and small alluvial floodplains made up a diverse terrain, but the far-spreading forest mantle tended to mask the many irregularities of the land surface.

Apart from the mountain tops the whole country was covered in dark green forest interrupted by a score of gleaming lakes and lagoons, occasional dull brown swamps and grey ribbons of open riverbed. It was a rain-drenched land of violent floods, but with milder temperatures and more abundant sunshine than on the southeast coast of the South Island. North of Mawhera (the Grey River), the physique of Westland formed a parallel pattern of terraced coastland, succeeded by north-trending mountain ranges and depressions such as the valleys of the Mawhera, Inangahua, Maruia and Orikaka. In the north, beech forest covered the hills and mountains, and podocarp, or 'pine', forest intermingled with the beech in the river valleys. South of the Taramakau the forests were composed of podocarp and broadleaved associations of subtropical luxuriance. There were a few patches of open land on high coastal terraces near Kawatiri, and belts of grassland, fern and open shrubland in the valleys of the Inangahua, Maruia and Mawhera. It is possible that fires lit by Maori hunting parties during infrequent dry seasons may have contributed to the extent and character of these open patches as the first Europeans described them.

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[3] Alexander Mackay: *Compendium of Official Documents Relative to Native Affairs in South Island* (2 vols), Wellington, 1873; S. Percy Smith: 'History and Traditions of the Taranaki Coast', *Journ. Polyn. Soc.*, Vol. 18, No. 4, 1909, pp. 183-204, and Vol. 19, No. 3, 1910, pp. 118-125; H. D. Skinner: 'Maori Life on the Poutini Coast', *Journ. Polyn. Soc.*, Vol. 21, No. 4, 1912, pp. 141-151 (incorporating manuscript notes of G. J. Roberts); J. W. Stack: 'Traditional History of the South Island Maoris', *Trans. N.Z. Inst.*, Vol. 10, 1877, pp. 57-92; W. T. L. Travers: 'On the Life and Times of Te Rauparaha', *Trans. N.Z. Inst.*, Vol. 5, 1872, pp. 19-93; G. G. M. Mitchell: *Maori Place Names in Buller County*, Wellington, 1948. The manuscript notes of G. J. Roberts form an important source of information on Maori life in Westland. As Commissioner of Crown Lands for Westland, Roberts interviewed at Bruce Bay in 1897 five Maoris whose ages ranged from fifty to ninety-seven.

THE PEOPLE

In the 1840's the hundred or so Maori inhabitants of Westland were strangely mixed in their tribal origins. This had resulted from sporadic invasions and conquests from the north and east which culminated in the raids of Te Rauparaha's musket-carrying warriors from the shores of Cook Strait in 1828 and 1836. The people were nominally the Poutini branch of the Ngai-tahu tribe, and they gave Westland its Maori name. The Ngai-tahu, who occupied the east coast of Canterbury, had invaded Westland towards the end of the seventeenth century, had overcome the original Ngati-wairangi occupants, and had incorporated the survivors in the Poutini Ngai-tahu.[4] After 1828 some of Te Rauparaha's Ngati-toa raiders from the North Island had settled on the coast,[5] and in the 1840's there were also some Ngai-tahu refugees who had fled from Te Rauparaha's war parties on the east coast.

Early European observers affirm that the total population of the Poutini coast was small even by South Island standards. Heaphy estimated that there were about seventy persons north of the Arahura River.[6] Brunner found ninety-seven between Kawatiri and Paringa, while a census of 1868 lists 116 persons, a mere five percent of the total Maori population of the South Island.[7] Warfare in the early nineteenth century had undoubtedly taken its toll, for there is some evidence of a larger population at an earlier date. One of Roberts's Maori informants said that more than 200 fighting men were mustered in defence of the hastily-fortified pas at Hokitika and Mawhera in 1836.[8] This could imply a total population of more than 500, but it is more probable that a large proportion of the fighting men were not Poutini but the erstwhile North Island invaders of 1828. Brunner describes 'a formerly large pa' together with 'some taro plantations of former days' on the south banks of the Hokitika River and the remains of a

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[4] Stack: *op. cit.*, p. 87.

[5] Heaphy: *Nelson Examiner*, 10 October 1846.

[6] Heaphy: *loc. cit.*

[7] A. Mackay: *op. cit.*, Vol. 2, p. 344.

[8] Percy Smith: *op. cit.*, 1910, p. 119.

'very large pa' at Okarito.[9] Sherrin found many whares on the south bank of the Poerua River and thought that a large number of natives must have at some time resided there.[10] The remains of more than one small pa, of stockades and of overgrown plantations were found along the coast north of Karamea by Heaphy and Brunner in 1846.[11] Mitchell describes Maori occupation of the Karamea district after 1750 and states that a track up the Karamea River was so well worn as to be observed by early farmers in the district.[12] Certainly, the number of oven-remains and artifacts found by settlers on the lightly-timbered river flats, and the very extensive ovens and shell heaps still to be seen in sandhills near the mouth of the Karamea River suggest former occupation of this warm and sheltered locality, although it was quite empty of settlement in 1846.

Hunters and Gatherers

Caution is necessary, however, in interpreting such evidence as pointing to a larger total population at earlier times. The dwellers on the Poutini coast had migratory habits, and their settlements were, at the best, semipermanent. Although there were small patches of riverbank cultivation in the 1840's it appears that the maize and white potato, leeks and sprouts, noted by Heaphy were introduced from the east coast after European vessels began calling at Banks Peninsula. The taro was probably brought from the Cook Strait area by Te Rauparaha's marauders. It appears that before the advent of European settlement in New Zealand no crops were cultivated on the Poutini coast. Heaphy insists that the Arahura natives did not have the kumara, or sweet potato, the basic and most widespread crop of Maori New Zealand.[13] There seems to be no reason why the kumara could not have been grown successfully on the virtually frost-free sites and well-drained silt loam soils near the river mouths, but without evidence to the contrary it must be assumed that until a few years before Heaphy and Brunner arrived the Poutini natives were hunters and gatherers of food and minerals, and were not cultivators.

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[9] Brunner: *op. cit.*, p. 360.

[10] R. A. A. Sherrin: 'West Coast Journal', [Christchurch] *Press*, 25 December 1863.

[11] Heaphy: *Nelson Examiner*, 12 September 1846.

[12] Mitchell: *op. cit.*, pp. 32–33.

[13] Heaphy: *Nelson Examiner*, 10 October 1846. For supporting evidence see Brunner: *op. cit.*, p. 374.

Despite the abundant harvest of swamp, river, lake and forest at some seasons of the year, it is unlikely that the natural food resources of the Poutini coast could have maintained a year-round population of more than a few hundreds. The working of greenstone gave rise to trade but it is doubtful whether there was any significant return flow of food. The quantity of kumara or fern root that a man could carry on his back from Kaiapohia to Arahura, in excess of what he would require on a transalpine march of two weeks or more, would not feed many mouths for long. On the south and east coasts of the island beyond the limit of crop cultivation, the Maori found in the root of bracken fern an abundant source of food to supplement the winter ration of preserved birds and fish. But the small scattered fern-root grounds on the Poutini coast could not have had an appreciable effect on the capacity of the land to support people.

Food Supplies

The food resources of the Poutini coast were spread out over a great extent of territory and necessitated long seasonal journeys for food gathering and the establishment of temporary settlements. Some indication of the Maori attitude to the value of particular pieces of country may be gained by studying the location of the native reserves laid out in agreement with the Maoris by James Mackay in 1860 when he completed the purchase of the west coast of the South Island for the Crown.[14] Although the introduction of crops had by this time reduced their dependence on plant and animal life it can be presumed that the Maori would want to reserve his most productive food-gathering grounds and that the reserves would include, in addition to burial grounds and pa sites, the most 'intensive' of his food-gathering sites.

Riverbanks and the shores of lakes and lagoons were the most valued sites of the Poutini natives. Not only did the rivers abound in eels and swarm with myriads of small *inanga,* or whitebait, but the shingle riverbeds were the only practicable routeways in such a densely forested land. They gave access to the bird-snaring and berry-gathering areas of the forests upstream and it was from the riverbeds of the Taramakau and Arahura that the greenstone was recovered after floods. Eels and whitebait from rivers and lagoons, and wekas from the forests fringing the riverbanks, were the mainstay of diet. Large quantities were sundried, preserved in fat and stored in seaweed bags for winter use.[15] Most of the native reserves laid out by Mackay are on the banks of the larger rivers within a mile of the sea. These were probably the most productive fishing grounds and today they are certainly the most desirable places for whitebaiting. Reserves at Okarito and Poerua border extensive lagoons, and other areas were marked out near the broad estuarine mudflats of the Orowaiti River near Kawatiri. Mackay's list includes a block of 150 acres about twenty-five miles up the Taramakau River on the open plain leading towards Lake Brunner. This was probably a source of fern-root and of birds for parties making the overland trip to Canterbury.[16] Reserves in the open country of the Mawhera Valley included some of the few fern-root grounds in Westland, while the largest single reserve of 3000 acres extended seven miles up the riverbed and along the banks of the Arahura.

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[14] J. Mackay: *op. cit.,* Schedule A: Reserves for Individual Allotments.

SCATTERED FOOD-GATHERING GROUNDS

Apart from these favoured sites, amounting to some 9000 acres, the resources of stone-age man in Westland were thinly and widely spread. Two extensive water surfaces, Lake Brunner and the Okarito Lagoon, were the resort of all kinds of waterfowl. On Lake Brunner, Rochfort identified 'paradise, grey and blue ducks, teal, crested grebe, rail, white cranes and seagulls, with an abundance of quail and woodhen on the plains'.[17] The largest of the west-coast lagoons, Okarito, is a seven-mile-long labyrinth of mudflats, tidal creeks and bush-clad promontories and islands, an ideal habitat for waterfowl. The prospector-explorer, Sherrin, said that grey and paradise ducks, spoonbill, teal and pigeons were to be found there in hundreds and that the water swarmed with 'herring, flatfish and whitebait'.[18] No doubt the other lakes and lagoons of the Poutini coast were visited on fishing and fowling trips, for most of them have Maori names,[19] but specific reference is made only to two of them, Kaurapataka, a charming alpine lake visited by parties on the Taramakau-Hurunui route to the east coast,[20] and Lake Rahui in the Buller Gorge.[21] Mussels were gathered and

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[15] Heaphy: *Nelson Examiner,* 10 October 1846.

[16] Since this reserve has never appeared on any published map it was presumably not confirmed.

[17] Rochfort: *op. cit.*, p. 297. The 'white cranes' were *kotuku* or white heron.

[18] Sherrin: *op. cit.*

[19] Of the larger Westland lakes only Hochstetter had apparently no Maori name.

[20] Skinner: *op. cit.*, p. 142.

[21] Mitchell: *op. cit.*, p. 41.

Fig. 1. Kaurapataka, a Maori food 'larder' in alpine Westla This area has seen little change since it was visited by Poutini Ngai-tahu making their trans-alpine journeys. The lake has never been stocked with introduced fish and it remains a virtual 'wilderness' in the Arthurs Pass national park area

occasional seals killed at points on the coast between the Potikohua River (Brighton) and Omau (Cape Foulwind). The Poutini natives rarely put to sea, but dogfish were caught off the rocks at Brighton and dried on stages erected in a large sea cavern. This fish was consumed at Arahura, fifty miles to the south.[22] Adzes and oven-remains found by settlers in some of the larger river valleys in south Westland suggest that such areas as the Whataroa, Wanganui and Kokatahi flats were visited for bird snaring. The light totara forest and the scattered belts of scrub and broadleaved shrubs and grassland that grew on these flats would be relatively easy to penetrate and were favoured haunts of the weka.

In north Westland the more 'extensive' of the food-gathering grounds were in the valleys of the Mawhera, Inangahua, Orikaka and Karamea. There is a striking relation between the distribution of these grounds and the occurrence of podocarp and broadleaved forest in an area which was covered, for the most part, in beech forest. Few New Zealand environments are more niggardly of food than the pure beech forest associations. Brunner's Maori companions on the homeward journey maintained that they would starve in the beech forests[23] and insisted that instead of striking across country they should follow the circuitous course of the Inangahua River where podocarp-broadleaved associations intermingled with the beech and where nectar and berry-bearing trees supported a more abundant bird life.

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[22] Heaphy: *Nelson Examiner*, 10 October 1846.

[23] Brunner: *op. cit.*, p. 370.

December was described as 'a glorious month of dietary among the natives on the coast'[24] when the rivers abounded in fish, the forest fruits ripened, and the birds grew fat on berries and nectar. In their wide-ranging summer migrations up the Mawhera Valley, Maoris from the Arahura district snared birds on the spurs of the Paparoa Range, caught eels in the river, dug fern root on the grassy parklands of the flood plain and low terraces, and made liquor from the tutu berries from shrub patches on the plains.[25] Further afield, the search for kakapo[26] in the upper Maruia, and for kiwi, kakapo and weka in the tributaries of the Buller, brought the Poutini Ngai-tahu into occasional conflict with the inhabitants of Golden Bay to the north.[27] The Ngati-tumatakokiri from northwest Nelson and the Poutini both claimed rights to the bird-snaring grounds of these distant interior valleys and made the disputed territory a skirmishing zone.

Pounamu

The most important area on the Poutini coast was the greenstone country, the mythical Waipounamu, comprising the riverbeds of the

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[24] *ibid.*, p. 363. [25] *ibid.*, p. 366.

[26] A parrot whose favoured habitat was the beech forest, subalpine grasslands and tussock flats of north Westland and Nelson.

[27] A. Mackay: *op. cit.*, Vol. 1, pp. 44-45.

Fig. 2. The greenstone country today. Where once the Maori sought *pounamu*, the pakeha now spreads tailings from a gold dredge. Nearby, on tiny flood-plain scrolls, the Arahura Valley is characterised by farmlands, with millable timber on the ridges beyond.

Taramakau and Arahura and the seabeach between them. The Westland greenstone, or *pounamu* of the Maori, is a true nephrite, translucent and typically dark green in colour. Some nephrites are as hard as or harder than steel[28] and on grinding could give the Maori a tool with a cutting edge surpassed by no other stone-age culture in the world. Because of its extreme toughness and great hardness the nephrite was keenly sought after for high-quality tools such as adzes, chisels and drill points.[29] Its scarcity and beauty made it a treasured medium for ornaments for people of high rank; and shortly before the European occupation of New Zealand greenstone was becoming recognised as a medium of exchange.[30]

Sources of Pounamu

The source of *pounamu* was a belt of ultrabasic igneous rocks occurring in several parallel bands intruded through the schists about two miles east of the Alpine Fault. The rocks have been mapped by Bell[31] in six localities in a twelve-mile belt in the basins of the Taramakau and Arahura. Nephrite is only one of a group of minerals so numerous that the belt has been described as a 'natural mineralogical museum'.[32] The intrusions occur at high altitudes in exceptionally rugged terrain and it is unlikely that the Maori ever discovered nephrite *in situ* or the fact would have undoubtedly been recorded in folklore. It was found in sizes varying from pebbles to large boulders in the river gravels of the Arahura and Taramakau. Nephrite has been sluiced in large quantities on gold-mining claims from glacial outwash gravels at Greenstone, Kumara and Waimea. The native reserve in the Arahura Valley extends seven miles upstream from the sea to Humphreys Gully and probably marks the limit of greenstone grounds of the Maori in the valley. This point coincides with the seaward limit of glacial moraine in the floor of the valley and would tend to suggest that the *pounamu* recovered by the Maori was the result of the reworking by streams of earlier glacial and fluvioglacial deposits. Chapman states that the Maoris also found greenstone on the seabeach where it had been cast up by the waves[33] and another source is described in a landslide in the Hohonu River,[34] a stream draining part of the moraine in the Taramakau Valley.

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[28] F. J. Turner: 'Geological Investigations of the Nephrites, Serpentines, and Related Greenstones used by the Maoris of Otago and South Canterbury', *Trans. Roy. Soc. N.Z.*, Vol. 65, 1936, p. 203.

[29] *ibid.*, p. 204.

[30] J. W. Stack in a personal communication quoted in F. R. Chapman: 'On the Working of Greenstone or Nephrite by the Maoris', *Trans. N.Z. Inst.*, Vol. 24, 1891, p. 514.

[31] J. M. Bell: 'Geology of the Hokitika Sheet, North Westland Quadrangle', *N.Z. Geol. Survey Bull. No. 1* (New Series), Wellington, 1906.

[32] *ibid.*, p. 67.

The special significance of the Poutini coast in the mineral economy of Maori New Zealand was that it was the only source of true nephrite, the hardest and toughest of the greenstones. Other greenstones, semi-nephrite from Lake Wakatipu and the translucent serpentine, *tangiwai,* from Milford Sound were found in localities even more remote from centres of population.[35] The original Ngati-wairangi settlers in Westland had discovered the Arahura greenstone and presumably established a coastwise, south-north pattern of mineral traffic long before the Ngai-tahu discovered the alpine passes from Canterbury.[36] It was in the eighteenth and early nineteenth centuries that the overland, west-east pattern of trade developed and that Kaiapohia became something of an emporium for the working and trading of greenstone. Much greenstone was carried out of Westland in an unworked state as pebbles or rough blocks on trading journeys or occasional plundering forays. Some was made up into ornaments by the Poutini natives themselves, and Heaphy and Brunner found the pa at the mouth of the Taramakau a veritable workshop for the manufacture of ear pendants and other ornaments.[37] Heaphy describes the use of 'mica slate' for sawing the *pounamu* when wet, while for grinding and polishing the Maoris used a calcareous sandstone which overlies the coal measures at Brunner.

ROUTEWAYS AND SETTLEMENTS

Seabed and riverbed were the natural trackways on the Poutini coast. Small canoes were used on rivers and lakes but Heaphy saw no craft capable of putting to sea. The Tasman Sea, with its constant swell and frequently heavy surf, would have made canoe voyaging a hazardous undertaking. Poutini tradition relates that the only long sea voyage made in earlier times was from Mahitahi (Bruce Bay) to Milford Sound in search of *tangiwai,* a journey made only about once in a generation.[38] Other tradition refers to a canoe route from the North Island and Nelson to the sheltered anchorage of Tauranga Bay near Cape Foulwind. Plundering parties are said to have left their canoes here and to have proceeded overland to the greenstone country.[39]

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[33] Chapman: *op. cit.,* p. 482.

[34] Skinner: *op. cit.,* p. 149.

[35] Turner: *op. cit.,* pp. 206–207. Turner also suggested that true nephrite may have been recovered by the Maoris from the belt of ultrabasic rocks in the Jackson River—Cascade area of south Westland.

[36] J. W. Stack: 'Traditional History of the South Island Maoris', *Trans. N.Z. Inst.,* Vol. 10, 1877, p. 87; and Roger Duff: *The Moa Hunter Period of Maori Culture,* Wellington, 1950, p. 249. Duff concludes that the use of nephrite was a rare, late and insignificant aspect of the culture of the South Island moa hunters. Only one adze for which an Arahura origin can be satisfactorily proven has been found in moa-hunter camps. Reasoning from this evidence and from early Maori tradition from the North Island, Duff suggests that the Arahura greenstone was first located by the Ngati-wairangi somewhere about 1400 A.D.

[37] Heaphy: *Nelson Examiner,* 10 October 1846.

The land route from Arahura southwards lay along sandy beaches and past a succession of boulder-strewn cliffs passable only at low tide and in calm weather. From Mawhera to Jacksons Bay there were twenty-three dangerous rivers to be forded or crossed by canoe or raupo raft. North of Mawhera the route traversed a bold, rock-bound coast where perpendicular cliffs had to be scaled by ladders of flax, rata and supplejack.

Transalpine Routes

The Maori, considering his utilitarian motives, made a significant contribution to transalpine exploration. His aim essentially was to get from coast to coast by the shortest and lowest routes and to locate suitable provisioning points to sustain his passage across extremely inhospitable country. Seven passes were used in varying degree, and present-day knowledge can add none more convenient. The favourite routes were Haast Pass, a low-level gap communicating with the Otago lakes district, and Hurunui or Harper Pass, the main route to Canterbury. The Hurunui route, with Lakes Brunner, Poerua and Kaurapataka on the western side and Lake Sumner and several smaller lakes on the eastern side of the divide, offered the traveller a safer route with the assurance of natural larders of fish and birds. One branch of the route led up the Hohonu Creek, crossed Lake Brunner by canoe, traversed the open plain by a small creek, and led to a portage to the Taramakau River. Another canoe route followed the Mawhera and Arnold Rivers to Lake Brunner, and a third choice was to paddle up the gorge of the Taramakau to the limit of canoe navigation at the junction of the Taipo River.[40] Browning Pass, which led from the Rakaia basin and was the reputed route of the first Ngai-tahu invaders of Westland, was still used occasionally by east-coast parties, while Whitcombe Pass, the highest and most difficult route of them all, was sometimes used on the return journey to the east coast.[41] It is said

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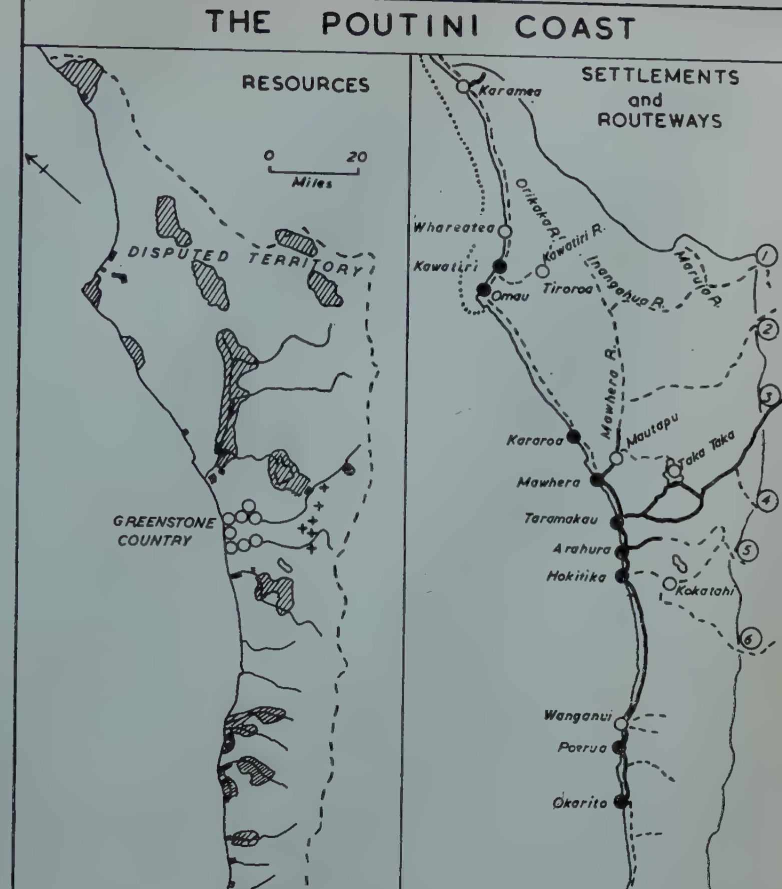
[38] Skinner: *op. cit.,* p. 145.

[39] Mitchell: *op. cit.,* p. 50.

[40] Skinner: *op. cit.,* p. 142.

[41] *ibid.,* p. 143.



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Lewis
Amuri
Hurunui (Harpers)
Arthurs
Brownings
Whitcombe
Haast.

that Arthurs Pass was used when entering Westland but that travellers laden with greenstone could not swim the pools in the Otira Gorge.[42] The two northernmost routes led from the Hanmer basin and Waiau into the headwaters of the Maruia via Lewis Pass, and via Amuri Pass into the Ahaura tributary of the Mawhera. These routes were used by Maoris from the Amuri district and Kaikoura coast.[43] Chapman considers that only at rare intervals did the east-coast natives make tribal expeditions in search of new supplies of greenstone.[44] In food the Poutini were self-supporting and greenstone was the only basis for transisland trade. The Poutini said they made the overland journey to Kaiapohia in summer, in small parties, generally of half a dozen and rarely of more than twelve.[45] They returned with valuable articles such as mats, or *taramea*—a scent made from the gum of the spear grass which grew on the tussock plains of Canterbury. Brunner was told of a party which crossed the island in seventeen days.[46]

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[42] The Bruce Bay Maoris questioned by Roberts were unable to confirm this tradition (Skinner: *op. cit.*, p. 143). But see H. R. Rae: *Pencillings by Land and Sea*, Hokitika, 1887, p. 177.

TABLE I

MAORI SETTLEMENTS ON THE POUTINI COAST

Settlement	Heaphy 1846	Brunner 1847
Kararoa	28 (plus men on way to Nelson)	6
Mawhera..............	2	20
Taramakau............	21 (plus large number of children)	24
Arahura..............	(Inhabitants absent)	3

There is evidence of Maori occupation of at least twenty settlements on the Poutini coast from Jacksons Bay to Karamea. Sixteen of the sites are on the seacoast or on riverbanks within a few hundred yards of the shore. Only four were inland and none of these was occupied when described by early travellers. Although thirteen settlements were occupied at some time between 1846 and 1860 only a few were inhabited at any one time. The population shifted both seasonally and over a period of years as food supplies became depleted or invading war parties took their toll. Evidence of rapid change in the population of individual settlements is provided by comparing Heaphy's estimates of 1846 with Brunner's enumeration made in 1847 (Table I). The settlements were located in four distinct groups with wide stretches of unoccupied country between. Flanking these, at the extremities of the region were single pa sites at Jacksons Bay and Karamea.[47]

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[43] Travers: *op. cit.*, p. 73; and John Rochfort: 'Notes of a West Coast Exploration', *Nelson Examiner,* 24 August 1859.

[44] Chapman: *op. cit.*, p. 499.

[45] Skinner: *op .cit.*, p. 143.

[46] Brunner: *op. cit.*, p. 370.

At the time of the visit by Heaphy and Brunner, the Kawatiri district had just begun to be reoccupied by the Arahura natives after the raids from the north during the previous two decades. A few potato plantations had been established in the hope of obtaining title to the district by occupation, and of selling them on favourable terms when the area was required for white settlement.[48] Tiroroa, fifteen miles up the Buller River, is the only pa in Westland where earthworks are still visible. Mitchell says this site was occupied intermittently until about 1850,[49] but it is not described by writers of that time. Its site on a steep hill with a commanding view down the Buller Valley gave the settlement a strategic location on one of the main routes to the summer bird-snaring grounds in the Orikaka, Inangahua and upper Buller Valleys. From Tiroroa, Poutini sentinels could give warning of the approach of unfriendly parties from Nelson and Golden Bay. Whatever its origin, it is significant that the only pa in Westland with earthworks should command the gateway to a disputed hunting ground.

A Major Area of Settlement

The second group of settlements lay between Kararoa and Hokitika and contained about two-thirds of the population of the Poutini coast at the time of Brunner's second visit. Apart from Kararoa, on a tiny patch of wooded land between steep mountains and a rocky shore, the coastal settlements were on the riverbanks. Taramakau, the largest settlement and the principal *pounamu* 'workshop', was described by Heaphy as 'more like a whaling station' than any place he knew. The houses had doors and chimneys and were apparently built in imitation of the European whaling stations of the east coast.[50] There were summer fishing stations on an island in the Mawhera[51] and on Refuge Island in Lake Brunner.[52] The lake pa was probably used as a retreat in time of invasion.

From Hokitika to the Wanganui River, a distance of almost forty miles, there are no recorded native settlements, and in 1860 the Maoris thought so little of this stretch of coast that they did not ask for any land to be reserved there. Wanganui was not occupied when visited by Brunner, and Poerua and Okarito, although they gave evidence of former large populations, appear to have been used chiefly as summer fishing and fowling villages for inhabitants of the Arahura district to the north and Bruce Bay to the south. The southern group of settlements was centred on Bruce Bay with Paringa as a summer residence for fishing. Little is known of Maori settlement further south and Mackay found only 'two or three old men' living at Jacksons Bay.[53]

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[47] Nothing is known of the particular site of the Karamea settlement. There may have been several in the district in the eighteenth century.

[48] Heaphy: *Nelson Examiner,* 3 October 1846.

[49] Mitchell: *op. cit.,* p. 47.

[50] Heaphy: *Nelson Examiner,* 10 October 1846.

[51] Brunner: *op. cit.,* p. 365. In 1948 a memorial was erected on the island commemorating Brunner's journey of exploration.

[52] Rochfort: 'Journal of Two Expeditions to the West Coast', *op. cit.,* p. 297.

Conclusion

In its human geography Maori Westland showed more similarities to other parts of the South Island than at any time since. If the north-east littoral from Banks Peninsula to Tasman Bay, with its crop cultivation and direct trade links with the North Island, is excluded, the similarities are even more striking.[54] The Poutini coast, together with Murihiku and Otago, was sparsely populated, remote from the routes of Polynesian migration in New Zealand, and late in its occupation by man. The Poutini settlers, as in Murihiku and Otago, lived in small, unfortified coastal villages which were occupied seasonally or for a few years at a time. They lacked cultivated crops and lived a seminomadic life gathering food along the coasts and rivers but making seasonal journeys to inland lakes or forest hunting grounds. Murihiku and Poutini both possessed the highly-prized greenstone minerals which gave rise to a small but far-spreading flow of trade. No other important resource of Maori New Zealand was so restricted in distribution and located so far from centres of population and trade. Differences between the Poutini coast and the south and east coasts of the island were in the smaller total population of Westland, the greater reliance on the food resources of river, lake and forest as compared with seashore and fern patch in Murihiku, the use of shingle riverbed and seabeach as the only trackways, and the sole possession of the most valuable of the greenstones, the true nephrite or *pounamu*.

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[53] J. Mackay: *op. cit.*

[54] This area of the South Island has been defined as one of three major geographic regions of late eighteenth-century New Zealand. It contained about three percent of the population. See Kenneth B. Cumberland: 'Aotearoa Maori: New Zealand about 1780', *Geog. Rev.*, Vol. 39, No. 3, July 1949, pp. 401-24. If one excludes consideration of the profound differences in the physical geography of the east and west coasts, the southern region of New Zealand, named 'Te Wahi Pounamu' by Cumberland, was more uniform in the character of its human geography than either of the two more northerly regions recognised in his geographical review of the whole country about 1780.

Despite the fundamentally different patterns of human geography which have succeeded Maori settlement in Westland, some elements have been persistent through several phases of European occupation. The main focus of the Poutini coast was in central Westland, on the Mawhera-Hokitika littoral and the Taramakau routeway. Here were the source of greenstone, the sites of the larger and more permanent villages, and the meeting point of routeways from north, south and east. In the late 1860's this area was to become the centre of the Westland gold country, with the site of the largest towns, the area best served with communications, and the scene of the first timber milling and the first intensive farming activities in Westland. The Taramakau-Hurunui routeway of the Maori was followed by the first explorers, surveyors and prospectors from Canterbury, and in 1865 it was the principal overland route used by the army of gold diggers.

EUROPEAN SETTLEMENT

Of the twenty Maori settlements shown on the map (*Fig.* 3) eleven have had European towns or townships built on or near the Maori sites.[55] Some of the Maori routes in north Westland are followed by modern roads, while in south Westland the beach route from Hokitika to Paringa gave the only land access to the southern blacksand gold diggings for some decades after the gold rushes. Of the seven alpine passes used by the Maori two are followed by modern highways, and the railway passes under one of these by means of the Otira tunnel. Of the remaining five, all except Whitcombe Pass have been used as stock routes at various times and are today crossed by rough foot tracks. All five are used at times by trampers, mountaineers and deer-stalkers. The Hurunui, the main transisland route of the Maori, has today only a walking track, but it probably carries a greater annual traffic of trampers and deerstalkers than it ever did of Maori traders.

Place names are the most permanent survivals of the Maori occupation of the Poutini coast. The modern map is indeed a document of Maori geography and is a lasting record of the territorial extent of Maori occupation. Along the coastline the number of Maori names far outweighs the European. Rivers, creeks, headlands, lagoons, rocks and offshore reefs all had their Maori names, most of which were adopted by early surveyors. Away from the coast, Maori names become much less frequent and rarely appear east of the Alpine Fault. Lakes, the larger rivers, the more prominent of the outlying mountains and the few patches of open land complete the list. Later, the gold diggers were to sprinkle the terrace country with distinctive and colourful names, while features in alpine Westland were to be named in much more prosaic fashion by government surveyors.

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[55] These sites were (original names in italics): *Karamea,* Karamea; *Kawatiri,* Westport; *Omau,* Cape Foulwind; *Mawhera,* Greymouth; *Mautapu,* Brunner; *Taramakau,* Whitcombe (for a short time after 1864); *Arahura,* Arahura River and Lagoon Townships (for a short time during the gold rush 1865-1868); *Hokitika,* Hokitika (on the opposite side of the river from the Maori settlement); *Okarito,* Okarito; *Mahitahi,* Bruce Bay (a sawmilling township in 1930's and early 1940's); *Okahu* (the Maori name recorded by Sherrin in 1863), Arawata Township (for a few years after the Special Settlement of 1875) and Jacksons Bay (a Public Works camp 1938-1948).

The arrival of an alien culture seeking gold, coal and timber brought a fundamental change in the appraisal of the resources of the Poutini coast and in its human geography. But Westland still fills its ancient role as a supplier to all New Zealand of a strongly-localised mineral resource. The intermittent trickle of *pounamu* has given place to a regular stream of bituminous coal which cannot be interrupted for long without causing serious damage to the economy of New Zealand.

THE OBLIQUE MERCATOR PROJECTION

L. P. LEE

EARLY in 1953 the writer was asked to design and compute a map to illustrate an air route from New Zealand to the United Kingdom. The projection to be used for the map was not in doubt; the air route is contained within a narrow belt crossing Australia, the Indian Ocean, and the Mediterranean, and an oblique Mercator projection erected upon a great circle centrally situated within this belt was an obvious choice.

The details were settled with the aid of a globe ten and a half inches in diameter on which the air route, with several alternative legs, was marked. Two circular rings, of ten and a half inches internal diameter, were cut from cardboard, one of them being then cut into two semicircular rings which were attached to the circular ring at ninety-degree intervals to make an open hemispherical cap which could be fitted over the globe. The circular ring marked a great circle, and the semicircular rings, besides ensuring correct contact between the circle and the sphere, also marked the pole of the great circle at their intersection.

In this way, a great circle passing through the antipodal points, latitude 43° south, longitude 180°, and latitude 43° north, longitude 0°, and crossing the equator at longitude 97½° east, was selected as the central axis of the projection. This great circle has a pole at latitude 46° 15′ 15″.797 north, longitude 172° 30′ west. A preliminary rough sketch was made by tracing from the globe on to a sheet of tracing paper making contact along the great circle, and subsequent plotting of the final map showed that the choice of great circle could hardly have been bettered.

At the same time, the writer noticed that another great circle, with a pole in the same latitude but fifteen degrees in longitude to the west (at longitude 172° 30′ east) would serve well as the central axis for a map of the sea route through the Suez Canal, and that the continuation of this great circle through the opposite hemisphere would cover the sea route through the Panama Canal, both routes being shown on one 'round-the-world' map. No further computation would be needed; the graticule of the air route map could be used again with the meridians renumbered.

As a matter of interest, therefore, the writer constructed a small-scale map of the sea routes (*Fig.* 1). For convenience in fitting the map to a prescribed page size, it is shown in two parts, but the two parts can be joined to form a continuous map, with either New Zealand or the United Kingdom in the centre of the strip.

The great-circle axis is shown by the central broken line, and the scale is constant along this axis. On either side of the great circle axis the scale is enlarged, but in a narrow strip of the sphere such as represented here this scale enlargement is very small. In this instance, where the map extends a little over twenty degrees on either side of the axis, the enlargement of the scale does not exceed six and a half percent.

This map is suggested as a suitable decoration for the office of a shipping company or tourist agency, or for the passenger lounge of a ship regularly operating over one of the routes, but it has more serious uses from the geographer's point of view. For example, it shows in rather striking form the importance to New Zealand of the two canals, and it serves also to correct some false impressions which can be gained by inspecting sea routes on the familiar Mercator projection. The eastern route through Panama keeps closer to a great circle than might be imagined, and the western route through Suez departs seriously from a great circle only for the necessary deviation around Spain and Portugal.

Historical Note

Practical use of the oblique Mercator projection is relatively recent, and the development of long-distance air transport has been an important factor in directing attention to the merits of this projection. Its first published use was in the *National Geographic Magazine* of March 1921, where it illustrated the flight of Sir Ross Smith from London to Sydney; the great-circle axis differed considerably from the axis of the map presented here, although in a general way the two maps are similar. In 1938 H. E. Walshe, then Surveyor-General of New Zealand, designed for the Centennial Atlas a map of the world on an oblique Mercator projection with New Zealand centrally situated; the map was drawn but has never been published. In 1940 A. R. Hinks drew attention to the merits of the projection for world maps,[1] and in the following year he figured several maps, of which one contained the land area of the world comfortably grouped about the central

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[1] A. R. Hinks: 'Maps of the World on an Oblique Mercator Projection', *Geographical Journal*, Vol. 95, 1940, pp. 381-383.

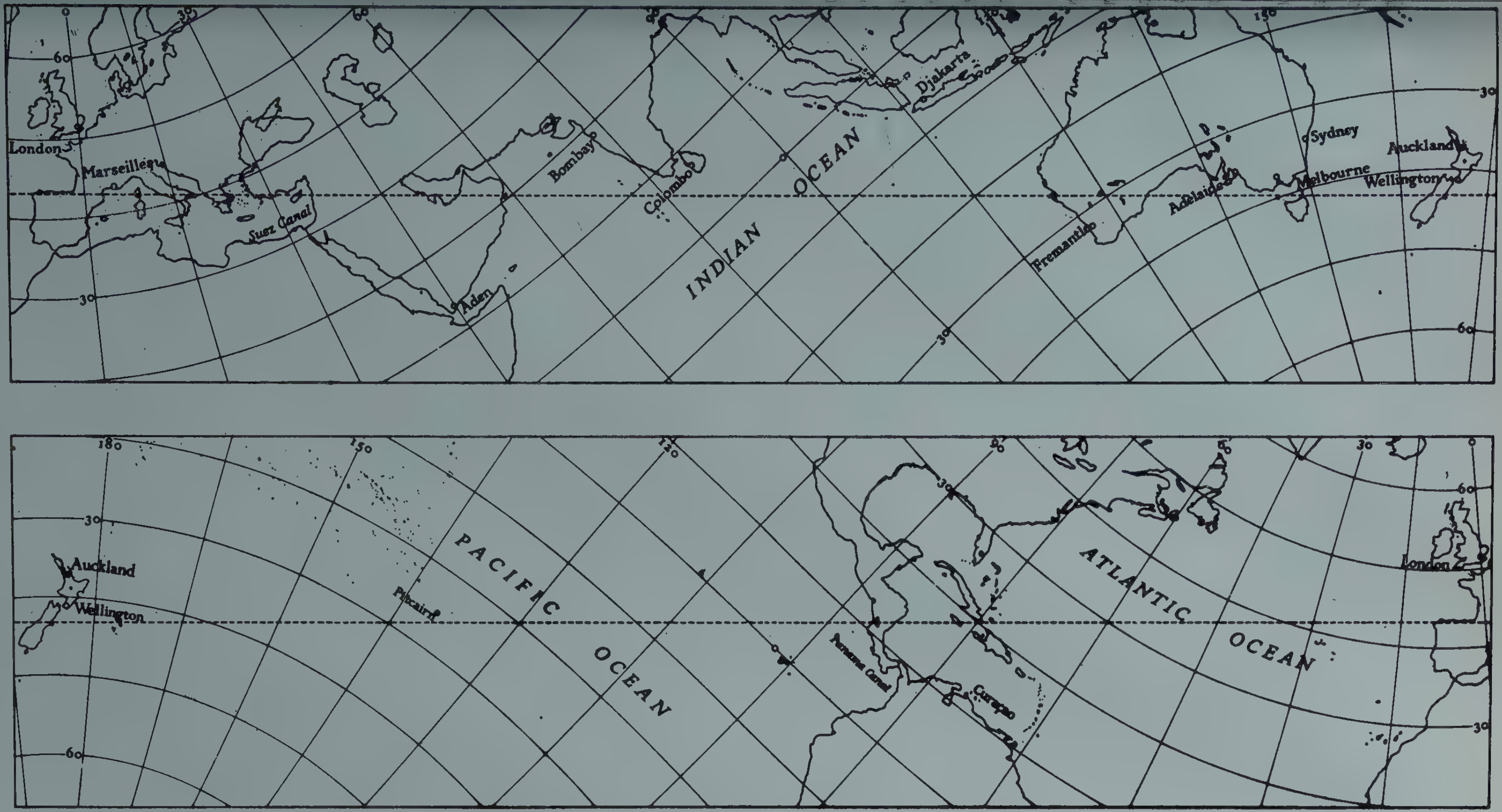

Fig. 1. Oblique Mercator projection of the sea routes from New Zealand to the United Kingdom, scale 1/100,000,000. The two halves of this figure are parts of a continuous 'round-the-world' map.

axis.[2] At about the same time G. T. McCaw described an oblique Mercator projection for the representation of the British Empire which he had designed some years earlier.[3] The U.S. Coast and Geodetic Survey has adopted the oblique Mercator projection for air route maps within the United States, and recently it has also been used as a survey projection of the spheroid for countries such as Malaya which are obliquely disposed to the meridians. It would be an eminently suitable projection for New Zealand, but the New Zealand National Grid was laid out on the Gauss-Krüger form of the transverse Mercator projection ten years before any mathematical investigation of the oblique Mercator projection of the spheroid had been undertaken, and its adoption as a standard reference system has now proceeded too far for a change to a new system to be desirable.

Practically nothing has hitherto been published on the mathematical theory of the oblique Mercator projection or on procedure in computation. The computation is not difficult, and is within the capabilities of mathematically-inclined geographers, and for this reason a detailed discussion is presented below.

Nomenclature of Mercator Projections

A word may be added on nomenclature. In the usage of British writers, the oblique Mercator projection is defined as an orthomorphic cylindric projection erected on a constant-scale great-circle axis which is neither the equator nor a meridian; the direct Mercator is a limiting case in which the central axis is the equator, the transverse Mercator is a limiting case in which the central axis is a meridian. The three projections are illustrated in Figure 3 below. In some American publications the term 'transverse Mercator' is often used to include both the transverse and oblique Mercator projections, although they are sufficiently distinct to warrant the use of separate names. Realising that all was not well with the terminology, a conference of aeronautical chart experts suggested the term 'inverse Mercator' to distinguish the projection known as the transverse Mercator. This additional—and not very appropriate—term does little to improve matters, and there seems to be no reason for departing from the British usage.

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[2] *idem:* 'More World Maps on Oblique Mercator Projections', *Geographical Journal,* Vol. 97, 1941, pp. 353-356.

[3] G. T. M[cCaw]: 'A Map of the Empire', *Empire Survey Review,* Vol. 6, 1941, pp. 160-166.

The present writer[4] has used the oblique Mercator projection for astronomical charts of the zodiacal regions, with the ecliptic as the central axis, to illustrate the annual motion of the planets with reference to the background stars. Not only did it seem a natural choice for this purpose, since the planets move within a narrow belt centred on the ecliptic, but it has a substantial advantage over any other projection in that it eliminates the computation of the correction for precession which must normally be applied to star places.

Astronomical Use

The graticule in this case represents the circles of right ascension and declination, which are analogous to the meridians and parallels of a terrestrial map, but the star positions relative to this graticule change with time, so that the chart can represent the configuration for a stated epoch only. Star places taken from a catalogue (as distinct from those taken from an annual ephemeris) must therefore be corrected for the change of epoch before the stars are plotted on the chart, a simple enough labour but a tedious one when many stars are involved. Neglecting the change in the obliquity of the ecliptic, which is only forty-seven seconds of arc per century, the change in star positions is the result of the movement of the equinox, the zero to which right ascensions are referred, along the ecliptic at the rate of fifty seconds of arc per year. In the oblique Mercator projection with the ecliptic represented by a straight line of constant scale, the effect is that the stars move uniformly with time in a direction parallel to the central axis, and this makes it possible to avoid the computation of corrections altogether. Fundamental stars are plotted on the chart from their mean places as given in an annual ephemeris for the epoch which the chart is to represent. A sheet of tracing paper is then laid over the graticule, and on this as many stars as desired, including a number of the fundamental stars, are plotted from their uncorrected catalogue positions. The central axis is also drawn on the tracing paper, which is then moved along the ecliptic until the two positions of each fundamental star coincide, and the positions of the additional stars may then be pricked through on to the chart.

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[4] L. P. Lee: 'The Planets, 1950', *N.Z. Astronomical Handbook 1950*, p. 22.

COMPUTATION OF THE POLE OF PROJECTION

In all the following formulae, ϕ denotes a latitude, reckoned positive northwards and negative southwards from the equator, λ denotes a longitude, reckoned positive eastwards and negative westwards from Greenwich. A longitude reckoned from the projection origin is denoted by ω.

The formulae of the oblique Mercator projection involve the latitude of the pole of projection, the pole of the great circle which is selected as the central axis. In general, the great circle would first be chosen to pass through two specified points, and the pole of projection would then be computed from these data.

If the great-circle axis passes through the two points (ϕ_1, λ_1) and (ϕ_2, λ_2), then the pole of projection (ϕ_0, λ_0) is found from

$$\left.\begin{aligned} \tan\lambda_0 &= -\frac{\cot\phi_1\cos\lambda_1 - \cot\phi_2\cos\lambda_2}{\cot\phi_1\sin\lambda_1 - \cot\phi_2\sin\lambda_2}, \\ \tan\phi_0 &= -\cot\phi_1\cos(\lambda_0-\lambda_1) = -\cot\phi_2\cos(\lambda_0-\lambda_2). \end{aligned}\right\} \quad (1)$$

If one of the two points, say (ϕ_2, λ_2), is on the equator, then the formulae take the simpler form,

$$\lambda_0 = 90^\circ + \lambda_2, \qquad \tan\phi_0 = -\cot\phi_1\sin(\lambda_1-\lambda_2). \quad (2)$$

GEOMETRICAL PROOF OF THE OBLIQUE MERCATOR FORMULAE

The formulae of the oblique Mercator projection can be established geometrically by regarding it as a Mercator projection erected upon an oblique axis.

On the sphere in Figure 2, the point Q is the pole of projection (ϕ_0, λ_0). N is the geographic pole, and the arc NQ is therefore $90^\circ - \phi_0$. The central axis is taken as the y-axis of the projection,[5] and the point O where it intersects the equator is taken as the origin of coordinates; the arc OQ thus becomes the x-axis. OQ and ON are quadrants, meeting QN at right angles, and therefore the longitude of O is $90^\circ + \lambda_0$. It follows that the angle QON $= 90^\circ - \phi_0$, and hence ϕ_0 is also the azimuth of the central axis where it crosses the equator. The meridian NO is taken as the origin of longitude for the purpose of projection, so that, if P is any point (ϕ, λ), the projection longitude of P is the angle ω between the meridians NO and NP, reckoned positive eastwards, or

$$\omega = \lambda - (90^\circ + \lambda_0). \quad (3)$$

If the great circle through Q and P meets the central axis at M, the arc OM and the arc MP are analogous to a longitude and a latitude respectively referred to Q as pole. If these arcs are denoted by θ and σ respectively, then in the spherical triangle QNP, the angle at Q is $90^\circ - \theta$, and the arc QP is $90^\circ - \sigma$. The angle at N is $90^\circ + \omega$, and the arc NP is $90^\circ - \phi$. Hence from this triangle we obtain

$$\left.\begin{aligned} \tan\theta &= \frac{\cos\phi_0\tan\phi + \sin\phi_0\sin\omega}{\cos\omega}, \\ \sin\sigma &= \sin\phi_0\sin\phi - \cos\phi_0\cos\phi\sin\omega. \end{aligned}\right\} \quad (4)$$

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[5] The conventions usual in geodesy and cartography are used here: x denoting a northing, y an easting, and angles being reckoned clockwise from north.

If now a Mercator projection is made of the point of longitude θ and latitude σ, the coordinates are

$$x = R\,\mathrm{gd}^{-1}\,\sigma = R\tanh^{-1}\sin\sigma,\ y = R\theta, \tag{5}$$

where R is the radius of the sphere reduced to the scale of the projection.

The scale coefficient k at the projected position of P is given by

$$k = \sec\sigma = \cosh(x/R). \tag{6}$$

Because of the symmetry of the projection, only one quadrant of the map need be computed,[6] any other quadrant being obtained from the first one by inversion, reflexion, or both inversion and reflexion. For convenience in plotting the map, the quadrant computed can be the quadrant contained between the arc QO and the meridian QN and their productions southward to the antipodes of Q. These two arcs are projected as straight lines, and the pole of projection Q is projected to infinity. For convenience in tabulating the coordinates, the computed quadrant could be a quadrant of the sphere contained between the meridians $\omega = 0$ and $\omega = 90°$.

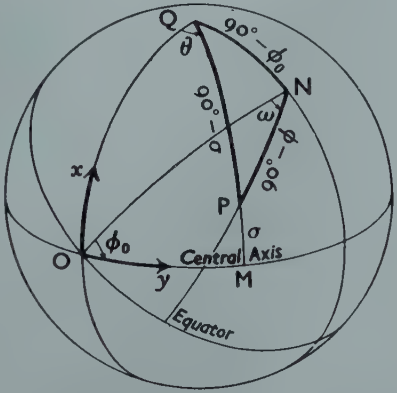

Fig. 2. Spherical triangle used in the geometrical proof of the oblique Mercator formulae.

Procedure in Computation

The formulae can be simplified in special cases.

On the x-axis, the intersections of parallels and of meridians are given by the following expressions:

$$\left.\begin{aligned} &\text{for a parallel,} && x = R\tanh^{-1}(\operatorname{cosec}\phi_0\sin\phi),\\ &\text{for a meridian,} && x = R\sinh^{-1}(-\sec\phi_0\tan\omega). \end{aligned}\right\} \tag{7}$$

The intersections of the parallels with the x-axis are points of inflexion.

On the y-axis, the intersections of parallels and of meridians are given by the following:

$$\left.\begin{aligned} &\text{for a parallel,} && y = R\sin^{-1}(\sec\phi_0\sin\phi),\\ &\text{for a meridian,} && y = R\tan^{-1}(\operatorname{cosec}\phi_0\tan\omega). \end{aligned}\right\} \tag{8}$$

The intersections of the meridians with the y-axis are points of inflexion.

On the straight-line meridian, $y = \frac{1}{2}\pi R$, the intersections of parallels are given by:

$$\left.\begin{aligned} &\text{for } \phi \leqslant \phi_0, && x = R\,\mathrm{gd}^{-1}[\phi + (\phi_0 - \tfrac{1}{2}\pi)],\\ &\text{for } \phi > \phi_0, && x = R\,\mathrm{gd}^{-1}[\phi \pm (\phi_0 - \tfrac{1}{2}\pi)] \text{ (two values).} \end{aligned}\right\} \tag{9}$$

In the general case, the procedure in computation will depend upon whether a calculating machine or logarithms will be used.

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[6] Assuming that the longitude interval of the graticule is such that the pole of projection lies on one of the plotted meridians or midway between two of them. Thus, in *Fig.* 1, the poles of the projection are at longitudes 7° 30′ west and 172° 30′ east; hence, meridians at five or fifteen degree intervals are symmetrical in each quadrant, while meridians at ten-degree intervals are not. But two hemispheres of the map are always symmetrical.

If a calculating machine is used, the computation of the coordinates of a graticule at regular intervals of latitude and longitude is simplified if the auxiliary functions:

$$a = \sin\phi_0 \sin\phi, \qquad b = -\cos\phi_0 \cos\phi,$$

are tabulated against the latitude, and

$$c = \sin\phi_0 \tan\omega, \qquad d = \cos\phi_0 \sec\omega,$$

against the longitude. The coordinates are then computed from:

$$x = R\tanh^{-1}(a + b\sin\omega), \quad y = R\tan^{-1}(c + d\tan\phi). \tag{10}$$

Successive values of tanh (x/R) are best computed by working along a parallel, as a and b are constant and may remain set on the machine. Similarly, successive values of tan (y/R) are best computed by working along a meridian.

For particular points such as cities and airports, the coordinates may be computed from:

$$\left.\begin{aligned} x &= R\tanh^{-1}\frac{-\sin\omega\cos\phi_0 + \sin\phi_0\tan\phi}{\sec\phi}, \\ y &= R\tan^{-1}\frac{\tan\phi\cos\phi_0 + \sin\phi_0\sin\omega}{\cos\omega}. \end{aligned}\right\} \tag{11}$$

With the formulae in this form, a transfer of figures from the product register to the keyboard is avoided, and the sequence of factors has been so arranged that the functions of one variable may be taken together.

Trigonometric functions occurring in these formulae may be taken from any convenient tables, and the inverse circular and hyperbolic functions and the inverse gudermannian may be taken from *Chambers's Six-Figure Mathematical Tables,* Volume 2, Tables VI A to VI D (pp. 336-401) and Table VII B (pp. 416-425).

If tables of inverse circular and hyperbolic functions are not available, and the older volume, *Chambers's Seven-Figure Mathematical Tables,* is used for this work, sin σ and tan θ may be computed from:

$$\sin\sigma = a + b\sin\omega, \qquad \tan\theta = c + d\tan\phi,$$

σ and θ then being obtained in sexagesimal measure by inverse interpolation, and θ being converted to minutes. The coordinates are now given by:

$$x = \frac{\pi R}{10800} M(\sigma), \qquad y = \frac{\pi R}{10800}\theta, \tag{12}$$

where $M(\sigma)$ is the 'meridional part' for argument σ, obtained from the tables on pages 418-426.

If the computation is to be done by logarithms, two auxiliary latitudes are introduced, defined by:

$$\cot\phi_1 = \cot\phi_0 \sin\omega, \qquad \tan\phi_2 = \tan\phi_0 \sin\omega,$$

and the values of ϕ_1, ϕ_2, log (sin ϕ_0 cosec ϕ_1) and log (cos ϕ_0 sec ϕ_2 sec ω) are tabulated against the longitude. Then

$$\left.\begin{aligned} \sin\sigma &= -[\sin\phi_0 \operatorname{cosec}\phi_1]\cos(\phi_1 + \phi), \\ \tan\theta &= [\cos\phi_0 \sec\phi_2 \sec\omega]\sec\phi\sin(\phi_2 + \phi), \end{aligned}\right\} \tag{13}$$

and the rest of the computation follows (5) or (12) according to the tables available.

For the positions of particular points such as cities, an auxiliary latitude is computed from:

$$\cot \phi' = \cot \phi \sin \omega.$$

The formulae then become:

$$\left.\begin{aligned} \sin \sigma &= -\sin \phi \operatorname{cosec} \phi' \cos (\phi_0 + \phi'), \\ \tan \theta &= \tan \omega \sec \phi' \sin (\phi_0 + \phi'), \end{aligned}\right\} \quad (14)$$

the rest of the computation following (5) or (12) as before.

General Theory of the Oblique Mercator Projection

For typographical simplicity, x/R and y/R are written as x and y in the following sections.

By the mathematical theory of orthomorphic (or conformal) projection, any such projection of the sphere can be defined by an equation of the form,

$$x + iy = f(\psi + i\omega), \quad (15)$$

where $i^2 = -1$, ω is the longitude referred to any convenient origin, and $\psi = \operatorname{gd}^{-1} \phi$. Hyperbolic functions of ψ, which is called the isometric latitude, are related to circular functions of ϕ. For example:

$$\sinh \psi = \tan \phi, \quad \cosh \psi = \sec \phi, \quad \tanh \tfrac{1}{2}\psi = \tan \tfrac{1}{2}\phi. \quad (16)$$

Conversely, any projection defined by such an equation involving complex variables is proved to be orthomorphic.

For the oblique Mercator projection, the definition is:

$$\tanh \tfrac{1}{2}(x + iy) = i \exp (-i\phi_0) \tanh \tfrac{1}{2}(\psi + i\omega), \quad (17)$$

where the origin of both (x, y) and (ψ, ω) is chosen at the intersection of the great-circle axis and the equator. The constant ϕ_0 is the latitude of the pole of projection and also the azimuth of the great-circle axis at the origin.

If particular values are given to ϕ_0, the two limiting cases, the direct Mercator and the transverse Mercator, can be derived from this definition, and the relationship of the graticules of the three projections is illustrated in Figure 3.

Thus, for $\phi_0 = \frac{1}{2}\pi$, equation (17) reduces at once to:

$$x + iy = \psi + i\omega, \quad (18)$$

which defines the direct Mercator projection.

For $\phi_0 = 0$, equation (17) becomes:

$$\tanh \tfrac{1}{2}(x + iy) = i \tanh \tfrac{1}{2}(\psi + i\omega) = \tan \tfrac{1}{2}i(\psi + i\omega),$$

or

$$x + iy = \operatorname{gd}^{-1} i(\psi + i\omega) = i \operatorname{gd} (\psi + i\omega),$$

which defines the transverse Mercator projection with the central meridian as the y-axis. It can be seen from Figure 3 that the coordinate axes must be rotated positively (clockwise) through a right angle to give the customary orientation with the central meridian as the x-axis. Hence, if the left-hand side is multiplied by i, the definition of the transverse Mercator projection becomes

$$x + iy = \operatorname{gd} (\psi + i\omega). \quad (19)$$

Equation (17), defining the oblique Mercator projection, can be expanded as:

$$\frac{\sinh x + i \sin y}{\cosh x + \cos y} = \frac{(\sin \phi_0 + i \cos \phi_0)(\sinh \psi + i \sin \omega)}{\cosh \psi + \cos \omega}.$$

Separation of the real and the imaginary parts gives:

$$\frac{\sinh x}{\cosh x + \cos y} = \frac{\sin\phi_0 \sinh\psi - \cos\phi_0 \sin\omega}{\cosh\psi + \cos\omega} = p,$$

$$\frac{\sin y}{\cosh x + \cos y} = \frac{\cos\phi_0 \sinh\psi + \sin\phi_0 \sin\omega}{\cosh\psi + \cos\omega} = q,$$

where p and q are auxiliary symbols introduced to simplify the algebra. Solution of these equations gives:

$$\left.\begin{aligned} \tanh x &= \frac{2p}{1 + (p^2 + q^2)} = \frac{\sin\phi_0 \sinh\psi - \cos\phi_0 \sin\omega}{\cosh\psi}, \\ \tan y &= \frac{2q}{1 - (p^2 + q^2)} = \frac{\cos\phi_0 \sinh\psi + \sin\phi_0 \sin\omega}{\cos\omega}, \end{aligned}\right\} \quad (20)$$

which give the coordinates of the oblique Mercator projection. If the hyperbolic functions of ψ are replaced by the corresponding circular functions of ϕ from (16), these formulae become identical with those in (11) established previously.

It can be noted that, for the special case of $\phi_0 = 45°$, the formulae take the simpler form:

$$\tanh x = \frac{\frac{1}{2}\sqrt{2}\,(\sinh\psi - \sin\omega)}{\cosh\psi}, \qquad \tan y = \frac{\frac{1}{2}\sqrt{2}\,(\sinh\psi + \sin\omega)}{\cos\omega}.$$

Differentiation of (20) gives:

$$\left.\begin{aligned} \frac{\partial x}{\partial\psi} &= \frac{\partial y}{\partial\omega} = \frac{\sin\phi_0 + \cos\phi_0 \sinh\psi \sin\omega}{\cosh^2\psi - (\sin\phi_0 \sinh\psi - \cos\phi_0 \sin\omega)^2}, \\ -\frac{\partial x}{\partial\omega} &= \frac{\partial y}{\partial\psi} = \frac{\cos\phi_0 \cosh\psi \cos\omega}{\cos^2\omega + (\cos\phi_0 \sinh\psi + \sin\phi_0 \sin\omega)^2}, \end{aligned}\right\} \quad (21)$$

in which the denominators of the two right-hand expressions are identical. The left-hand parts of these expressions are the Cauchy-Riemann equations which express the fundamental conditions for an orthomorphic projection.

From the general theory of orthomorphic projection, the scale coefficient k is now given by:

$$k = \cosh\psi \left[\left(\frac{\partial x}{\partial\psi}\right)^2 + \left(\frac{\partial y}{\partial\psi}\right)^2\right]^{\frac{1}{2}}$$

$$= \frac{\cosh\psi}{[\cosh^2\psi - (\sin\phi_0 \sinh\psi - \cos\phi_0 \sin\omega)^2]^{\frac{1}{2}}} = \cosh x. \qquad (22)$$

The general definition (17) can also be expressed in the inverse form:

$$\tanh \tfrac{1}{2}(\psi + i\omega) = -i \exp (i\phi_0) \quad \tanh \tfrac{1}{2}(x + iy), \tag{23}$$

which can be expanded as:

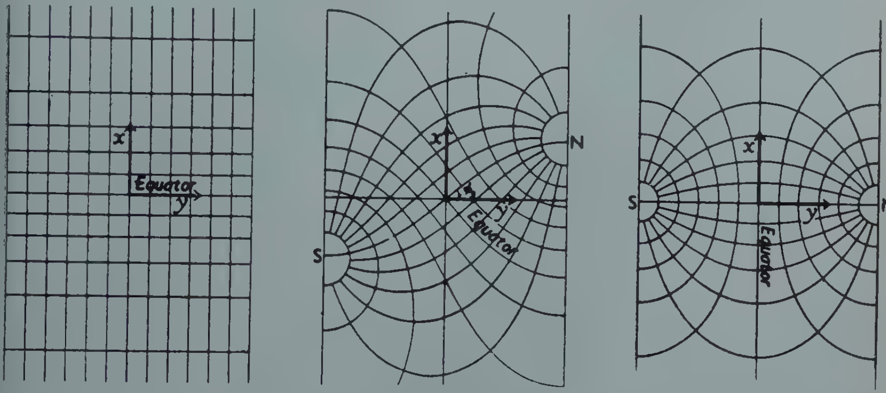
$$\frac{\sinh \psi + i \sin \omega}{\cosh \psi + \cos \omega} = \frac{(\sin \phi_0 - i \cos \phi_0)(\sinh x + i \sin y)}{\cosh x + \cos y}.$$

Separation of the real and the imaginary parts gives:

$$\frac{\sinh \psi}{\cosh \psi + \cos \omega} = \frac{\cos \phi_0 \sin y + \sin \phi_0 \sinh x}{\cosh x + \cos y} = p',$$

$$\frac{\sin \omega}{\cosh \psi + \cos \omega} = \frac{\sin \phi_0 \sin y - \cos \phi_0 \sinh x}{\cosh x + \cos y} = q',$$

where again p' and q' are auxiliary symbols. Solution of these equations gives:



N.Z. GEOGRAPHER, OCT., 1954

Fig. 3. Graticules of the oblique Mercator projection (centre and its two limiting cases, direct Mercator (left) and transverse Mercator (right).

$$\left.\begin{aligned} \sin \phi = \tanh \psi &= \frac{2p'}{1 + (p'^2 + q'^2)} = \frac{\cos \phi_0 \sin y + \sin \phi_0 \sinh x}{\cosh x} \\ \tan \omega &= \frac{2q'}{1 - (p'^2 + q'^2)} = \frac{\sin \phi_0 \sin y - \cos \phi_0 \sinh x}{\cos y} \end{aligned}\right\} \tag{24}$$

which can be used for the inverse computation of (ϕ, ω) when (x, y) are known.

The four quantities are related by the equation,

$$\cosh \psi \cos y = \cosh x \cos \omega, \tag{25}$$

which can be used as a check on either the direct or the inverse computation.

NATURE OF THE GRATICULE

Expressions (24) give also the equations of a parallel and of a meridian in the resulting graticule.

From the first expression in (24), the equation of a parallel is:

$$\cos \phi_0 \sin y = \sin \phi \cosh x - \sin \phi_0 \sinh x. \tag{26}$$

For $\phi = \phi_0$, the parallel of the pole of projection is given by:

$$\sin y = \tan \phi_0 (\cosh x - \sinh x), \tag{27}$$

whence it can be seen at once that $x = \infty$ when $y = 0$, and the x-axis is an asymptote to the curve. This parallel divides the family of parallels into two groups according as ϕ is greater than or less than ϕ_0. Differentiation of (26) gives:

$$\frac{dy}{dx} = \frac{\sin\phi \sinh x - \sin\phi_0 \cosh x}{[\cos^2\phi - (\sin\phi \sinh x - \sin\phi_0 \cosh x)^2]^{\frac{1}{2}}}$$

and hence:

$$\frac{dy}{dx} = 0 \text{ when } \tanh x = \frac{\sin\phi_0}{\sin\phi}.$$

This is possible only when $\phi \geqslant \phi_0$, and at such a point the curve is parallel to the x-axis. Parallels for $\phi > \phi_0$ form closed curves around the projected position of the geographic pole. Also,

$$\frac{d^2y}{dx^2} = \frac{\cos^2\phi\,(\sin\phi \cosh x - \sin\phi_0 \sinh x)}{[\cos^2\phi - (\sin\phi \sinh x - \sin\phi_0 \cosh x)^2]^{\frac{3}{2}}}$$

and hence:

$$\frac{d^2y}{dx^2} = 0 \text{ when } \tanh x = \frac{\sin\phi}{\sin\phi_0}.$$

This is possible only when $\phi \leqslant \phi_0$, and, from (26), clearly occurs when $y = 0$. Parallels for $\phi < \phi_0$ therefore have a point of inflexion where they cross the x-axis.

From the second expression in (24), the equation of a meridian is:

$$\cos\phi_0 \sinh x = \sin\phi_0 \sin y - \tan\omega \cos y. \tag{28}$$

Differentiation of this expression gives:

$$\frac{dx}{dy} = \frac{\sin\phi_0 \cos y + \tan\omega \sin y}{[\sec^2\omega - (\sin\phi_0 \cos y + \tan\omega \sin y)^2]^{\frac{1}{2}}},$$

$$\frac{d^2x}{dy^2} = \frac{\sec^2\omega\,(\tan\omega \cos y - \sin\phi_0 \sin y)}{[\sec^2\omega - (\sin\phi_0 \cos y + \tan\omega \sin y)^2]^{\frac{3}{2}}},$$

and hence:

$$\frac{d^2x}{dy^2} = 0 \text{ when } \tan y = \frac{\tan\omega}{\sin\phi_0}.$$

Equation (28) shows that this occurs when $x = 0$, and the meridian therefore has a point of inflexion on the y-axis.

Both parallels and meridians are symmetrical periodic curves with a quarter-period of $\frac{1}{2}\pi$ in the y-direction.

From the general theory, the radii of curvature of a parallel and of a meridian, R_p and R_m respectively, are given by:

$$\frac{1}{R_p} = \frac{\partial}{\partial\psi}\left[\left(\frac{\partial x}{\partial\psi}\right)^2 + \left(\frac{\partial y}{\partial\psi}\right)^2\right]^{-\frac{1}{2}}, \quad \frac{1}{R_m} = \frac{\partial}{\partial\omega}\left[\left(\frac{\partial x}{\partial\psi}\right)^2 + \left(\frac{\partial y}{\partial\psi}\right)^2\right]^{-\frac{1}{2}},$$

which, after some easy manipulation, can be reduced to:

$$R_p = \sec\phi_0 \operatorname{sech}\psi \operatorname{cosec} y, \quad R_m = \sec\phi_0 \sec\omega \operatorname{cosech} x. \tag{29}$$

The projection convergence γ, the inclination of a meridian to the x-axis or of a parallel to the y-axis, is given by:

$$\tan \gamma = \frac{\partial y}{\partial \psi} \bigg/ \frac{\partial x}{\partial \psi}$$

$$= \frac{\cos \phi_0 \cosh \psi \cos \omega}{\sin \phi_0 + \cos \phi_0 \sinh \psi \sin \omega} = \frac{\cos \phi_0 \cosh x \cos y}{\sin \phi_0 - \cos \phi_0 \sinh x \sin y'} \qquad (30)$$

this angle being positive for a clockwise rotation from the x-axis to the projected meridian.

Computation of a Great-circle Course

Any great circle on the sphere cuts the equator in two antipodal points, and is thus analogous to a meridian referred to those two points as 'geographic poles'. Hence the projection of any great circle on a direct, a transverse, or an oblique Mercator projection can be made to coincide with a meridian on a transverse Mercator graticule. The determination of the great-circle course between any two points can therefore be done graphically by fitting a transverse Mercator graticule over the map so that the two central axes coincide, and sliding the graticule until the same meridian passes through both points. The great-circle distance between the two points can also be read off by means of the latitude graduations on the meridian. The graphical method has the disadvantage that, because of the limited number of meridians that can be shown on a graticule, it may not be possible to find a meridian which will fit the two points exactly, but a simple procedure of computation can be devised.

Substituting $\phi_0 = 0$ in the equation (28) of a meridian of the oblique Mercator projection gives:

$$\sinh x = - \tan \omega \cos y$$

as the equation of a meridian of the transverse Mercator projection with the central meridian as the y-axis. With a change of origin of ω and of y, this can be written as:

$$\sinh x = K \cos (y + y'). \qquad (31)$$

If this meridian is to pass through the two points (x_1, y_1) and (x_2, y_2) on a direct, a transverse, or an oblique Mercator map, the equations:

$$\sinh x_1 = K \cos (y_1 + y'), \quad \sinh x_2 = K \cos (y_2 + y'),$$

must be satisfied, and hence:

$$\left.\begin{aligned} \tan y' &= \frac{\sinh x_1 \cos y_2 - \sinh x_2 \cos y_1}{\sinh x_1 \sin y_2 - \sinh x_2 \sin y_1}, \\ K &= \frac{\sinh x_1}{\cos (y_1 + y')} = \frac{\sinh x_2}{\cos (y_2 + y')}. \end{aligned}\right\} \qquad (32)$$

When y' and K have been found, the x-coordinates for any values of y intermediate between y_1 and y_2 can then be computed from (31), and the course of the great circle can be plotted. It should be remembered that in these formulae x and y are used as abbreviations of x/R and y/R.

It follows that every meridian of the oblique Mercator projection will be identical with a meridian of the transverse Mercator graticule. The general equation of a meridian (28) will represent the same curve as the transverse meridian (31) if the following relations hold between the different origins of ω and of y:

$$\tan y' = \sin \phi_0 \cot \omega, \qquad K^2 = (\sin^2\phi_0 + \tan^2\omega)/\cos^2\phi_0.$$

Extension to the Spheroid

The general equation of an orthomorphic projection (15) will define a projection of the spheroid if the appropriate spheroidal isometric latitude,

$$\psi = \ln \left[\tan\left(\frac{\pi}{4} + \frac{\phi}{2}\right) \cdot \left(\frac{1 - e \sin \phi}{1 + e \sin \phi}\right)^{\frac{1}{2}e} \right], \tag{33}$$

where e is the eccentricity of the meridian, is used instead of the spherical isometric latitude $\psi = \text{gd}^{-1}\phi$. An oblique Mercator projection of the spheroid may therefore be established by methods similar to those of the foregoing sections, leading to formulae which, except for the scale coefficient, are identical in form with those for the projection of the sphere.

Hotine,[7] using quite a different method of approach, by projection through an aposphere as intermediate surface, has derived a projection in which the coordinate formulae, with the notation and sign conventions of the present paper, are:

$$\left.\begin{aligned} \tanh \frac{B}{A}x &= \frac{\sin \alpha_0 \sinh B\psi - \cos \alpha_0 \sin B\omega}{\cosh B\psi}, \\ \tan \frac{B}{A}y &= \frac{\cos \alpha_0 \sinh B\psi + \sin \alpha_0 \sin B\omega}{\cos B\omega}, \end{aligned}\right\} \tag{34}$$

in which α_0 is the azimuth at which the central axis crosses the equator, and A and B are constants selected to give minimum scale variation along the axis for the map of a small area. For a 'round-the-world' map it is sufficient to take $B = 1$ and $A = a$ (the major semiaxis of the spheroid).

Unlike the projection of the sphere, the oblique Mercator projection of the spheroid does not maintain a constant scale along the central axis. The scale coefficient can be put in the form:

$$k = \frac{A}{\nu} \cosh \frac{B}{A}x,$$

where ν is the radius of curvature of the spheroid perpendicular to the meridian, and varies with the latitude. On the central axis $x = 0$, this becomes $k = A/\nu$ which varies slightly with the value of ϕ or of y.

The nature of the curve on the spheroid which becomes the central axis of the projection calls for some further comment. This curve is not a geodesic (an oblique geodesic on the spheroid is not a closed curve), nor is it any other of the curves commonly regarded as 'corresponding' in one way or another to great circles on the sphere. The theory of conformal representation demands that the curve selected as central axis shall be a member of an isometric system of curves on the spheroid. This requirement is sufficient to specify the curve uniquely, but the various possible isometric systems, with the exception of the special case of meridians and parallels, have not received any further distinguishing names.

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[7] M. Hotine: 'The Orthomorphic Projection of the Spheroid, III', *Empire Survey Review,* Vol. 9, 1947, pp. 66–67.

GEOGRAPHY IN SCHOOLS . . . .

6. *An Examiner's Viewpoint**

James W. Fox

IN THE SPHERE of education, examinations have long been the object of discussion and controversy, but despite their limitations, no effective substitute has yet been found. As a pedagogic device they have their place at all stages of a child's scholastic development—as tests of acquired knowledge and of ability to handle that knowledge, and as yardsticks to be used by the teacher assessing the efficacy of his own work. Such examinations are, of course, internal, and it is not until the School Certificate stage is reached that pupils must face the ordeal of papers set by external examiners. The examinations conducted by the University of New Zealand follow—University Entrance for non-accredited pupils, and, two years after School Certificate, the Entrance Scholarships examination. All three examinations are based on published prescriptions, and since they are dominion-wide in their scope, it may be claimed quite fairly that the examiners concerned are in a position to make objective assessments, not only of the candidates' relative merits in any particular subject, but also of the work of teachers—particularly of the standards and methods of teaching so palpably obvious in the quality of answers set down.

Examinations in geography provide no exception to this thesis. Rather, by virtue of the fact that the subject in its modern form is of comparatively recent growth in New Zealand schools, does the teaching of geography evince all the characteristics of an uneasy transition—the persistence of outworn methods; the inability of teachers to keep clearly in mind what is and what is not essential in their teaching since they are not certain of the content of their subject; and the lack of appreciation by both teachers and taught of basic techniques.

The Approach to Geography

Put quite simply, geography is an appreciation of place—of man and his activities, of various physical characteristics, insofar as they help to produce distinctiveness. No two places are exactly alike. This precept is the core of geographical study, and from it springs that curiosity which is the motivating force. Sometimes the distinctiveness of a place is recognised in the 'totality' of phenomena that exist there together. This is regional geography. Sometimes it is useful to illustrate that agriculture varies from place to place, as does climate and surface configuration. This is systematic geography, which may also be defined as 'topical' geography, since it is concerned with the areal differentiation of one group of related phenomena. This systematic geography constitutes the basis of study of world patterns of climate, agriculture, transport, and so on, from which evolve the climatic, agricultural and transport regions of the world. The geographic regions of regional geography cannot conform to any world pattern since they are delimited in terms of all significant phenomena grouped within the areas concerned, and they are accordingly unique.[1]

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* The observations made in this article are an expression of the author's opinions after five years of examining for School Certificate, University Entrance and Entrance Scholarships. They do not necessarily conform with those held officially by the examining bodies nor with those of other examiners.

Competence in geographical appreciation demands a wide knowledge, a knowledge which must become increasingly deeper as the university level is approached. The School Certificate examination fittingly lays emphasis on description and factual knowledge, but at the Entrance Scholarships stage the candidate is expected to interpret these facts and to make some evaluation of regional distinctiveness. In other words, after two years in the sixth form the pupil should be trained sufficiently to take his place in the first-year class at the university—and, incidentally, it may be argued that if the university is to maintain adequate and reasonable standards all students must remain in the sixth form for two years. The geography teacher in the sixth form, therefore, has a specific and important task. His pupils will demand more of him than previously. They will look to him for inspiration, and he in turn must stimulate their critical faculties. A reference library of university textbooks is no substitute. To the unguided, uninspired schoolchild it is as trackless as a desert, bewildering in its immensity—and as arid.

The function of geography teaching in school, then, is to develop interest, to awaken and encourage curiosity about other people and places, and to satisfy that curiosity, ensuring all the time that the child learns as he reads, writes and sees. To have a standard of assessment the pupil must know thoroughly his home area. If he does not, differences will mean but little, and the materialistic aspect of not appreciating even his own district and country will surely condemn both pupil and teacher—and, perhaps, geography itself.

With this object in view the teaching of geography—whether it be formally or as a component part of the core subject known as Social Studies—begins with the local area. The school district, the town, the major regional division and the country as a whole are logical steps in developing, simply at first, an appreciation of place. The study of the home country completed, the teacher should proceed to interest his pupils in those areas which are not highly complex and which show affinities with the homeland—from New Zealand to Australia, the Union of South Africa and Argentina, for example. In this way comparison and contrast becomes relatively easy and the way is prepared for the study of the more complicated landscapes of Asia, North America, Europe and the British Isles, preferably in that order. A final year—the School Certificate year—should be spent in emphasising again the geography of the home country and of those parts of the world which have close connections with New Zealand.[2]

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[1] A useful distinction in nomenclature may be noted here. All areas which are recognised by the geographer as distinctive may be termed *geographical* regions since they have been determined by techniques peculiar to geography. Accordingly, agricultural regions, industrial regions, climatic regions, landform regions, and all other regions in systematic geography are geographical regions, as are those differentiated by the complex of phenomena which in totality distinguish them. However, these last are the regions of regional geography, and their individualities are assessed in a manner different from those of the regions in systematic geography. To such regions the name *geographic* may be given, and they may be deemed to possess geographic personality, for just as personality is a particular combination of traits common to many, so geographic regions are distinguished by a particular combination of phenomena which individually have a wider distribution. Geographic personality, then, cannot be ascribed to the regions of systematic geography since there phenomena interrelated in one aspect only are considered.

[2] Such a course in geography envisages an integrated five-year development from Form I to Form V, the realisation of which would help significantly to ameliorate existent ills. The problems raised by the present uncoordinated syllabi are discussed below.

Written Work and the Teacher

As was suggested above, description and factual knowledge, and the ability to show how areas differ, are all that are demanded at the School Certificate level. To this end, textbooks, pictures, films and other printed and visual aids are called upon as well as the teacher's own knowledge. It is the teacher who decides what must be read and what must be seen, and who by his enthusiasm encourages the class. The teacher who cannot handle his material, who relies upon textbooks chapter by chapter, and who fails to make proper use of visual aids, fails in his duty as a teacher and as an exponent of his subject.

But organisation and teaching are not enough. Factual knowledge must be tested and some assurance gained that geographical appreciation is developing. Mapwork, written tests and essays are all-important. To show a film or to indulge in project work without preparation or follow-up is so much wasted time. To accept a geographical essay which is devoid of sketch maps is to admit that basic techniques have not been taught or are not understood. It must be realised that if problems of this nature are not faced here they will mar progress forever afterwards, for sixth-form work needs this necessary grounding. It is an incontrovertible fact that at present the average School Certificate candidate can neither present facts individually—witness the lamentably poor showing in 'location' or 'place' geography[3]—nor can he coherently express his ideas in map and essay. The teacher must accept the blame. To copy blackboard summaries, to makes notes on chapters of textbooks, to write down laboriously information dictated by the teacher, and to compile masses of irrelevant detail in so-called projects, makes little contribution to geographical training. These pedagogic devices have virtue as *aides-mémoire,* but they do not develop pupils' ability to think for themselves or to expound their own opinions. Moreover, they can in no way cultivate felicity and nicety of expression. The teacher of geography must inevitably be as concerned with the correct use of language as he is with the proper use of geographic terms and with the application of geographic techniques. It would seem, then, that the present deplorable state is to be attributed to the fact that in New Zealand schools not enough written work of educational value is set and painstakingly checked.

Nor is the situation much better in the sixth form where written work in geography plays an increasing role, for not only must the pupil demonstrate his ability to interpret the regional differences which become apparent to him, but he must also handle his material with facility. He must understand fully the jargon of his subject; he must appreciate more than ever the value of the geographer's techniques; and he must be able to apply his knowledge. Boys and girls who have been left to their own devices or to the tender mercies of teachers whose knowledge of geography is rudimentary or archaic must inevitably make a poor impression when committed to dominion-wide examinations—simply because their education has been neglected.

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[3] The significance of this problem has been commented upon before. Ten years ago B. J. Garnier pointed to the poor results obtained by training college students and schoolchildren (*N.Z. Geographer,* Vol. 1, No. 1, April 1945, pp. 87-88), and more recently G. Guy has drawn attention to similar faults (*ibid.,* Vol. 8, No. 1, April 1952, pp. 73-75). It is surely axiomatic that one cannot talk intelligently of places the location of which is not properly known, and it is suggested that this deficiency is consequent upon present-day teaching methods. Teachers must demand from their lower-form pupils work based on maps and short answers, and from their fifth forms geographical essays in which maps have been intelligently incorporated.

The fact that many do not take the University Entrance examination after one year in the sixth form, but are accredited, means that young people are foisted on the business world with an inadequate comprehension of geography—and worse, by virtue of their achievement, possess the statutory right to lumber first-year courses at the university.

Those pupils who remain in the sixth form for a second year in order to proceed to the Entrance Scholarships examination can, under similar circumstances, fare no better. Usually they have not undergone the trial of the University Entrance examination, and often enough they are not the most capable pupils in the form. Consequently, they need more than ever that competent guidance which seems to be so lacking. No wonder, then, that candidates who present geography as one of their subjects in this final school examination fail to obtain high ranking, and head teachers, jealous of their reputations, tend to steer brighter youngsters towards subjects which are apparently more mark-worthy.[4]

The teaching of geography in New Zealand schools has now reached the point at which a complete and objective appraisal becomes necessary. The advances made over the last ten to fifteen years have been notable, but if consolidation of these improvements is to be effected and if further developments are to be made, the present deficiencies must be made good—be they the result of the teaching methods themselves, of the organisation of the subject in the schools, or of the examination prescriptions laid down. In any case it must be recognised that it is the teacher who holds the key to the solution of the problems now confronting not only the schools but also, to a smaller extent, the university.

Use of the Topographic Map

An appreciation of place may be inculcated in several ways. The best is to examine the actual area, and in this respect the thorough understanding of the local region becomes fundamental to all geographical study. Journeys and field camps heighten this reality in geography teaching, and if the topographic map is intelligently used in combination with these experiences the child is prepared for the next step—the use of the map to gain an insight into what other places are like. Topographic maps are not exact portraits of areas, and until the schoolchild appreciates their virtues and their deficiencies he will always be at a disadvantage.

So important is the topographic map in the study of the geography of the home country that in any examination at least one question—a compulsory one—is based on it. School Certificate candidates are asked to describe the country portrayed; those at the later stages are expected to interpret the geographic character of the area. In every instance, examinees must be able to recognise the patterns of distribution of significant features and to show how these features in combination vary from place to place. Single-topic sketch maps here provide a valuable aid to analysis—

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[4] A striking commentary on this is provided by the performance of 'Quiz Kids' in radio programmes broadcast in New Zealand. Questions of a geographical nature are primarily those concerned with 'location' geography, and the correct answer is given but rarely. If these presumably more 'intelligent' children are studying geography, such failures constitute a further disparagement of teaching methods. If they are not, it surely behoves all teachers of the subject to ask themselves why.

maps of surface configuration, drainage, natural vegetation, communications, settlement, field boundaries, industrial establishments, and any other notable features of the landscape. But to analyse is not enough. Synthesis into geographic regions—regions with distinctive personalities—on the basis of the information to be culled from the map is just as important, or more so, since this form of generalisation represents essentially the geographer's contribution to the understanding of areas.

The candidate's prowess in dealing with this type of question is a measure of his ability as a geographer. There are some who confine themselves to the description of physical features, often interpreting 'landscape' in a restricted sense;[5] there are some who concern themselves primarily with explanation, emphasising the evolution of landforms, or seeking to show how the physical characteristics of the area have conditioned human activities; and there are some who make unwarranted assumptions, guessing, for example, that factories marked on the map are dairy factories and that large paddocks indicate sheep-farming economies. Such examinees amply demonstrate the deficiencies of their training. They have not that 'eye for country' so essential to the geographer, nor have they been imbued with that necessity for careful observation which is the hallmark of competence in areal description and interpretation.

For examination purposes a topographic map is often chosen because within a limited compass it highlights many of the essential features of distinctive areas. The candidate is then expected to apply the map in his assessment of the geographic personality of the major region by exemplifying his points from the features illustrated. That many fail to do this adequately when answering this type of question suggests that there is a lack of appreciation of the topographic map and that the knowledge of regional characteristics comes only from rote learning of textbook material. If pupils understand the geography of Westland or Northland or the Hauraki Plain they will surely recognise the essential traits of the region in any relevant topographic map set before them. Teachers must realise that topographic maps are a means to regional appreciation and that they are both an aid to and a substitute for actual field investigations when their virtues and limitations have been recognised.

Mapping of Statistical Data

The value of maps and mapping in any geography course cannot be stressed too highly, for mapping is essentially a geographic technique. Maps are the geographer's chief tool and represent one of his major contributions to the understanding of what places are like. Two aspects may be noted here: the mapping of statistical data and the use of sketch maps. The former is part of work in the sixth form where the systematic aspects of the subject begin to receive greater attention. By the time they are ready for the Entrance Scholarships examination pupils should have mastered the techniques of illustrating statistics by absolute and relative methods, particularly dot maps, piegraphs and bargraphs in the first case, and density shading in the second. All have their uses, advantages and disadvantages, and of these the candidate must be aware if he is to propose a solution to any relevant problem put to him. But such problems should not be studied *in vacuo*. They must constitute an integral part of the study of the geography of a region, country or continent, or, possibly, of the world. The maps must be accurate; they must be both precise and concise. Slipshod methods of cartographic representation cannot be tolerated, for if they are, the virtue of statistical mapping is lost. Finally, the fact that the function of statistical maps is to help in the interpretation of areal differences means that they are to be studied by pupils only after they have mastered the art of accurate description; accordingly, statistical mapping finds its place only in sixth-form courses in geography.

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[5] It must be remembered that a landscape is made up of both physical and cultural elements, just as topography is the description of a small area and does not refer merely to the surface configuration of that area.

Sketch Maps

On the other hand the sketch map should be a universal tool. In lower forms it is of necessity simpler, being mainly a method of illustrating a particular point. The important thing is that the pupil shall be trained in its use, so that in the fifth and sixth forms the drawing of sketch maps becomes second nature. If any major criticism is to be levelled at the teaching of geography generally in New Zealand schools it is that there is inadequate realisation of the value of sketch maps. These freehand sketches—and they must be freehand, not traced—speak volumes in themselves. Not only have they intrinsic value, but also they demonstrate an examination candidate's ability to select essential criteria. Economy of line demands that significant elements alone must be illustrated—the physical characteristics of a town site, the distribution of major manufacturing activities in an industrial region, the relative extent of cultivated land *vis-à-vis* the area under natural vegetation in a region of pioneer farming, and so on. Moreover, sketch maps need not be ornate—pencil and pen are often adequate, and at most these may be supplemented by four coloured pencils, red, green, blue and brown.

But originality is to be sought. Sketch maps are the product of ideas as well as of geographic knowledge. They cannot be 'learned', and their value lies in their execution and composition. They are at one and the same time a touchstone and measuring rod, and for these reasons alone the slavish reproduction of maps from textbooks is to be avoided. Teachers of geography would do well to insist on sketch maps on every occasion—as summaries of lessons, as integral parts of geographical essays, as short tests of acquired knowledge—but at the same time they must critically examine their own pedagogic methods. Pupils cannot be expected to appreciate the overwhelming importance of these maps if during lessons teachers themselves do not produce and use them purposefully and efficiently.

The Teaching of Systematic Geography

Reference may now be made to some of the apparent deficiencies which characterise the teaching of systematic (topical) and regional geography. Since the former is largely the preserve of sixth-form geography the specialist teacher cannot escape responsibility. Landforms, climate, vegetation and soils are the physical phenomena which are to be studied in their world patterns, whilst from the human aspect, agriculture, mineral and power resources, manufacturing industries, population and settlement, and transport must also be examined. It is obvious at the outset that to cover these adequately is impossible. Some judicious choice must be made and some omissions countenanced. The result is often tantamount to a telescoping into world patterns of economic geography, based on available textbooks, these being supplemented by geomorphological studies, again founded on textbooks—geological textbooks—and by a survey of the 'natural' regions of the world. Alternatively, some teachers, eager to present new ideas, introduce material garnered from first-year lectures at the university. The consequences are more often than not chaotic. Even worse is the indiscriminate use of university textbooks.

The cardinal rule in any pedagogic method, geography not excluded, is 'from the particular to the general'; there is little point in dissipating a pupil's energy in the study of abstract notions. The specific area must receive attention first, even in systematic geography, and for this reason it is suggested that 'topical' is the better attribute for this approach to the subject since then teachers are reminded that topics may be studied in particular and representative areas. In this way the child amasses a wealth of concrete knowledge which he can draw upon in later life, and should he enter the university, he will be the better able to appreciate the generalisations which of necessity constitute much of a first-year course in geography.

Study of Specific Areas

Following these precepts, landforms should not be studied *per se* from geomorphological textbooks. That they often are is a condemnation of the teacher, sometimes because the pupil is left to his own devices, sometimes because the teacher is not cognisant of the methods of study of his subject. Moreover, such textbooks emphasise the genetical approach. It cannot be stressed too highly that origin and development are significant to the geographer only in the interpretation of regional differences; it is much more important to know what places are like in terms of one feature or a combination of features. Thus an appreciation of glaciated mountain areas is not gained by diligently explaining how *cirques* or *arêtes* are formed, how hanging valleys have been created, and why moraines, *roches moutonnées* and erratic boulders happen to be where they are. A better approach would be to examine the Southern Alps, the Highlands of Scotland, and the Norwegian coast as they are in reality, how all these features typical of glaciated mountain areas exist together in area, and what is their significance in the human geography of those regions. Similarly limestone country should not be studied simply from the viewpoint of limestone as a rock formation. The northern King Country of New Zealand, the Causses of France, and the downlands of England offer concrete examples for investigation. There the problems of water-supply, thin soils and access, and the characteristics of short grass and scrub, nucleated settlement and sheep-rearing economies may be exemplified, and the dangers of preoccupation with the origins of sink-holes, stalagmites and stalactites, and other incidental features will be avoided.

Clearly such expositions tell but part of the story, but once these particular examples are known the pupil may proceed to comparative studies within the general world pattern—and this he might well do by himself since by then he will have mastered the technique of geographical appreciation. This thesis may be developed for the whole gamut of topical studies in geography; and with the deeper understanding that will accrue from the adoption of these methods, regional geography itself will benefit. No longer will the climate of the Indian subcontinent be an exposition of why and where the monsoons occur; no longer will the landscapes of hot deserts be described in terms of the genesis and development of hamada and erg; and no longer will industrial regions be necessarily coterminous with coalfields.

THE TEACHING OF REGIONAL GEOGRAPHY

The faults to be observed in the teaching of regional geography are of a different order, and it must be acknowledged that this aspect of pedagogy in New Zealand has shown vast improvement over the last ten years. Problems here are symptomatic of the late recognition of geography as a worthwhile discipline, not only in the schools but also in the university. The dominance of physical geography, the baneful influence of environmental determinism, and, perhaps, the notion that geography was economic geography plus maps and, possibly, accounts of exploration, have all contributed to conceptual and methodological confusion in this country. That these ideas still linger cannot be denied, for examination answers demonstrate their persistence.

Nevertheless the crucial point today is not what regional geography is, nor what it should be. The problem lies in the methods of teaching, and these in large part are a reflection of the ill-organised examination prescriptions and of the dependence on outmoded textbooks. Far too frequently overemphasis on physical geography vitiates areal description, and so-called geographic regions are on many occasions nothing more than physiographic regions. Surface configuration may contribute significantly to the character of a geographic region, or it may not, but in either case to establish physical boundaries *ab initio* indicates a complete misunderstanding of the regional approach in geographical studies.

Yet it must be recognised that teachers in New Zealand are faced with real problems in their attempts to cover examination prescriptions. Much is left to chance and to the hope that the examination candidate will somehow be able to undertake extra reading and so make his own preparations. Naturally enough teachers attempt to 'spot' questions, and tend to confine their treatment of regional geography to a series of readily-defined regions. Consequently, to quote but two examples, Europe receives scant treatment east of Germany, and Asia apparently embraces little beyond Japan, China, India and Pakistan. The regional geography of New Zealand presents a different case. Whereas for other parts of the world few suitable 'regional' studies exist and teachers must perforce make their own interpretations, for this dominion the relevant numbers of the *Post-Primary School Bulletin* provide all that is needed —and more. But so great is the lethargy of teachers, or so completely occupied are their time and interests, that the regional geographies here set down are assumed to be infallible and immutable, and it is assumed that the problems cannot be tackled in any other way. Examiners find that these bulletins have been practically learned by heart, and no matter how the question is phrased, the material is always set out in a manner almost identical with the original. This grievous fault again emphasises lack of inspiration on the part of the teacher and, on the pupil's part, insufficient training in the handling of geographic data.

GEOGRAPHY AND SOCIAL STUDIES

Most of the evidence adduced so far points to deficiencies in teaching methods, but the teacher is not the only sinner. It is quite apparent that not enough time is devoted to geography *qua* geography in schools, that in many schools the organisation of the subject is at fault, and that the dominion's school system as a whole must share part of the responsibility. All three points are intimately related. Many teachers of geography claim that only in the fifth form does preparation for external examination begin and that it is impossible to cover the School Certificate prescription in one year. That is patently obvious, but to reduce the scope of the prescription provides no solution if the School Certificate is to be regarded as a warranty of adequate schooling. The answer lies in the quality and quantity of work in the lower forms, and in this respect Social Studies must be called to account. A vigorous defence of this hybrid subject has already been put forward,[6] and one must agree that Social Studies properly taught can make a useful contribution to history and geography as such. But normally most teachers cannot achieve the complete integration required. A knowledge of history and geography does not necessarily produce competence in the teaching of Social Studies, much less so if a teacher is proficient in only one of the subjects. And what of the poor unfortunate who happens to have a blank in his timetable when a lower form requires a lesson in Social Studies? Apparently anyone and everyone contributes to the confusion, each according to his inclination and training. Some heads of Social Studies departments have no specific training in geography, and they fail to appreciate that Social Studies is a course 'in history and geography'—in other words that an integration of these two disciplines was intended by those who framed the prescription. One is tempted to suggest that as long as promotion is by seniority, little immediate success will attend the development of Social Studies in school since many years must pass before the capable young graduate trained in geography will be able to make his mark.[7] Little wonder then that standards of fifth-form work in geography range from good to the utterly ridiculous; little wonder that the better pupils are guided towards subjects which have received a more thorough treatment in the lower school.

Finally, one must agree with Miss Gorrie when she point out[8] that if Social Studies is to be recognised as a distinctive discipline it should be capable of examination at the School Certificate level. The division into history and geography in the fifth form savours a little of making two subjects where there was previously but one, with the result that the submission of five subjects for the School Certificate examination is rendered all the easier. Consequently those pupils who are not forced to work at high pressure in the fifth form are only half-prepared for the examination. Those who are cajoled or coerced into some semblance of competence reach a stage of near-exhaustion at the end of the year—as do their teachers. All would benefit if geography were regarded always as a distinctive subject in the post-primary school, to be taught by geography specialists appreciative of the place of their discipline in the education of a child.[9]

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[6] See Rilda Gorrie: 'Geography and Social Studies in the Post-Primary School', *N.Z. Geographer,* Vol. 9, No. 1, April 1953, pp. 66–71.

[7] Trained geographers in this sense are graduates who have passed three stages of geography in their degree examinations. Ideally they should also have proceeded to a master's degree in the subject.

[8] Gorrie: *op. cit.,* p. 71.

[9] This implies recognition of geography as a social study and of the part it can play in developing the child's awareness of the world around him. Moreover, the teacher of geography cannot succeed in his task unless he pays due regard to work in other subjects, especially history and English, and much can be achieved by happy cooperation among all three. It is not necessary to formulate a rigid syllabus which purports to be a synthesis of social studies. No teacher worth his salt needs regimentation of that kind.

To this end all teachers' training colleges could make their contribution. In many of these institutions in the past the training of students in the teaching of geography has been little concerned with geography method. Too much time and energy has been absorbed in ensuring that prospective teachers possessed an adequate background of factual knowledge –in short, the deficiencies in work which should have been completed as a schoolchild have had to be made good. Thus if adequate training to the School Certificate level could now be successfully undertaken, the training colleges might well be able to lay even greater emphasis on methods of teaching geography, to the advantage of everyone. Today there are enough expert geographers in the colleges to ensure this, for it is obvious that geography method cannot be expounded by anyone else. Similarly, it is questionable whether the competence of a teacher of geography can be assessed by authorities who have received no training in the subject, and it is interesting to speculate on the number of inspectors and headmasters who fall within this category.

Geography as a Continuous Study

Another aspect of the organisation of geography in schools needs attention, namely the place of the subject in Forms I and II, especially in the intermediate school which has tended to create a scholastic world of its own. The aim of all education is the progressive widening of experience. With this object in view the syllabi in all schools must be framed so as to secure unbroken progression, and this demands integration within the school system, particularly for children of eleven years of age and over. Accordingly, geography taught in the five forms prior to the School Certificate examination should show continuous development from the home region to the regional geography of the world, and it should not matter where the child studies for the first two years. That being so, the geography specialist in the post-primary school would be able to accept his third-form pupils confident of their ability to proceed to an ever-widening study of world regional geography. The aggravation of 'starting all over again' would be avoided. In the same way, if Social Studies as such were abandoned, the geography teacher in the fifth form would not be compelled to cover again a whole examination prescription to rectify his colleagues' sins of omission and commission. Teachers themselves, and the Department of Education as the controlling authority, hold the key to the effectuation of reform in this direction.

Progression in Examination Prescriptions

On the other hand the university can also help since it is the arbiter of those examination prescriptions which direct the work of the sixth form. Ideally again the progressive burgeoning of the youthful mind must be a guiding principle. From the viewpoint of geography, then, the aim must be gradual transition from the regional geography of the world[10] to the general systematic geography of a first-year university course. This can be achieved in the first sixth-form year by confining the study of regional geography to two continents of contrasting development and by introducing topical geography in the guise of broad world patterns of physical and cultural phenomena. During the second year the regional geography should become even more specialised, being confined to a detailed study of the homeland, New Zealand, whilst courses in systematic geography demand close attention to physical elements. Omission of the systematic treatment of cultural elements is intentional, since relevant source material is more difficult to obtain. For the teaching of physical geography textbooks are available and competent teachers can guide the studies of their pupils to greater advantage.

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[10] This presumes that school courses in geography have been reorganised to this end. Such a reorganisation has now been set further away by the introduction in 1954 of the new School Certificate prescription, which restricts the scope of regional studies. This is an attempt by teachers to redress the difficulties now apparent in fifth-form work—difficulties that should never have occurred.

Modifications of the prescriptions for the University Entrance and the Entrance Scholarships examinations to accord with these proposals would meet with the full approval of the university teachers of geography. Students entering the university would feel no qualms in undertaking first-year courses, and those who meanwhile had passed into the professional and business world would be all the better equipped to face demands made upon them. Schoolteachers, too, might well offer their support to these modifications and so initiate a chain of reform in the teaching of geography which, with goodwill on all sides, could extend back to the first-form level.

The teaching of geography in New Zealand schools has shown remarkable improvement since the second World War. Yet no system of education is perfect, and there is no room for complacency among teachers. If criticism be frowned upon, or if the need for further improvement be denied, the future of geography teaching in this country is indeed black. Geography has gained stature these last ten years, and by the efforts of its teachers it will achieve that wider recognition it so richly deserves.

AUSTRALIA: A REVIEW OF RECENT LITERATURE*

BRYAN H. FARRELL

THE analysis of a group of papers written by geographers in a country can very often indicate the direction in which geographic research within that country is moving. The trend can be more easily evaluated if the number of people working in the field is small. This is the case in Australia where, before 1950, the University of Sydney had the only full department of geography, and the number of persons engaged in research was smaller than it is today. Since the mid-century, which can justifiably be said to mark the renaissance of geography in Australia, at least four full departments and one chair of geography have been established. With this in mind, the series of papers reviewed below will indicate in some small measure the trend of contemporary geographical research in Australia and the changes that have taken place since 1950. The six papers chosen fall naturally into two groups. The first discusses settlement and urban geography, the second examines aspects of land use and agricultural geography.

SETTLEMENT AND URBAN GEOGRAPHY

In the first group are two articles which discuss the characteristics of early settlement in Cumberland County and the genesis and development of the city of Sydney. In the first paper[1] problems of land use and population distribution during the first thirty years of the colony are effectively examined.

In a second and shorter article,[2] Robinson focuses most of his attention on characteristics of Sydney in 1820 and on those connections existing between the first settlement and the core of the present commercial city. Thus it is not a paper tracing the growth and changing character of Sydney from 1820 through to 1952, and there is little information about contemporary Sydney apart from a map showing zonal groupings in the central city core. Despite a misleading title, and sketch maps that have suffered from excessive reduction, the reader will find much that is worthwhile in this paper.

Sydney in 1820 was sited on a promontory between Darling Harbour in the west and Woolloomooloo in the east. Sydney Cove, an indentation at the north of the promontory, together with the valley of Tank Stream formed the main focus of

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*A comprehensive survey of recent geographical literature on Australia and New Zealand was published in 1948 (R. G. Bowman, 'A Walkabout Down Under: Recent Geographical Literature on Australia and New Zealand', *Geogr. Rev.*, Vol. 38, No. 2, April 1948, pp. 250-270). This review considers several papers appearing recently in geographical periodicals and written by geographers. Important publications in fields cognate with geography have been omitted. No direct reference is made, for instance, to the Land Research Series of the Commonwealth Scientific and Industrial Research Organisation, nor to a number of most useful resource surveys produced by the Premier's Department in both Victoria and New South Wales, by the Bureau of Industry in Queensland, and by the Commonwealth Department of National Development.

[1] K. W. Robinson: 'Population and Land Use in the Sydney District 1788-1820', *N.Z. Geographer,* Vol. 9, No. 2, October 1953, pp. 144-160. Although published second this paper is logically first in the series.

[2] *idem:* 'Sydney, 1820-1952: A Comparison of Developments in the Heart of the City', *Australian Geographer,* Vol. 6, No. 1, June 1952, pp. 6-12.

early settlement. The western ridge and slopes at either side of the valley were occupied by military, convict and civil establishments. To the east, running back from Sydney Cove, were the Governor's domains. This early arrangement of functional areas with buildings in the west and open spaces to the east is still obvious today. As well there is a strong correlation between the administrative area of 1820 and that of 1952, and the Circular Quay shipping area is still important, but now rather for transharbour ferries than for overseas shipping. Also since 1820 a warehouse and light industrial zone has developed to the east of the Darling Harbour area. The major present day retail shopping area has replaced the main residential district of 1820. Today the contrasts with the second decade of last century are marked. The strongest ties lie with certain aspects of the unplanned street pattern and the very general connection between some functional areas of the present city and those of the past.

Robinson has contributed two valuable papers about Sydney and its immediate hinterland. It is to be hoped that he will complete a trilogy with an account of Metropolitan Sydney and Cumberland County today.

The Geography of a Capital City

King,[3] in the final paper of the first group, considers the relationships existing between 'two segregated aggregations of urban folk'—between two towns of vastly different character only seven miles apart but each lying in a different political territory. Canberra on federal territory and Queanbeyan in New South Wales are discussed systematically in terms of evolution, present morphology and function. Finally the nature of the particular interdependence, 'mutualism', is considered.

Canberra is a planned capital city which, although still in its infancy, has now a population of over 30,000. The history of the area from pastoral frontier to capital city first occupied in 1927, is adequately outlined. So too is Walter Burley Griffin's city plan. The city is set upon a former lake plain and is fringed with rounded hills which rise a few hundred feet above the general level surface. Although Capital Hill the site of a future Parliament House is planned as the key point, the actual 'centre' of the present city lies further to the north near the Molonglo River in open land partially used for agriculture.

In a very general manner functional areas extend from a central inner zone of parks and open spaces through an administrative area to an outer residential zone located mainly in the north and south. Within this arrangement are three small business areas: Civic Centre, Manuka and Kingston. King shows the functional pattern by means of a diagram consisting of a series of concentric circles. On this 'an arcuate "ribbon" of agriculture transects the three functional zones'. Unfortunately this diagrammatic representation seems to be of doubtful value as it implies a precise geometrical arrangement which is not present in the land-use map upon which it is based.

Canberra's major function is administrative. As well as being the seat of government it houses the head offices of a growing number of government departments and national organisations. It has become not unimportant as a tourist and conference town. In marked contrast to the capital is the small rural centre of Queanbeyan which provides a variety of regional services for country districts within thirty miles. This smaller centre has developed along conventional Australian lines. Streets are of a checkerboard pattern and only one business area has developed—mostly along the main thoroughfare.

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[3] H. W. H. King: 'The Canberra-Queanbeyan Symbiosis: A Study in Urban Mutualism', *Geogr. Rev.*, Vol. 44, No. 1, January 1954, pp. 101–118.

At an early period Canberra depended on Queanbeyan for supplies of food and drink. Today 900 to 1000 people live in Queanbeyan and travel to work in Canberra, commercial interests in Queanbeyan have branches in the adjacent city, and many business enterprises based on the smaller town operate successfully in the capital. On the other hand Queanbeyan gets its water from the Capital Territory and on Saturday mornings the town is invaded by shoppers from Canberra.

In many ways the peculiarities of interdependence are highlighted in a paper illustrated with well-chosen photographs, but marred by the exaggerated use of jargon and the questionable use of biological analogy. The diagrams are impressive by their very novelty, but at times they hardly contribute to the rapid understanding of the problems discussed.[4]

LAND USE AND AGRICULTURE

The first two papers of the second group are concerned with farming, mainly in tropical areas of Australia. Tweedie has written a very useful geographical summary of the characteristics and regional variety of sugar-cane growing in Queensland.[5]

In a paper describing climate and cattle production in the Cairns-Normanton area of Queensland,[6] Simonett follows a line of enquiry which, with much justification, has become traditional in Australian research—the relationships between climate and farming activity. In an area of 40,000 square miles in the south of Cape York Peninsula cattle holdings are large—from 200 to 2000 square miles in extent—and are located in country ranging from mountains of 3000-5000 feet in the east through upland and lower country to broad featureless plains in the west. Woodland of various types covers the area. Natural pastures vary considerably in palatability and food value. There appear to be strong correlations between pasture, soils and underlying rock material. Over most of the area rainfall is about thirty inches a year and of this about eighty percent falls from December to March.

Although fattening and breeding are carried on in some limited upland areas, the major activity is store-cattle production, an activity fraught with many problems. Cattle starve part of each year as a result of seasonal fluctuation in pasture growth, and under certain conditions tick infestation is heavy, and this leads very often to a higher mortality rate during the critical dry period in September and December. Yet, even in years of severe drought, large stations never provide supplementary feed, and it is only recently that a few smaller holdings have used selective hand feeding.

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[4] See also *idem:* 'Factors of Site and Plan' in H. L. White (ed.): *Canberra, A Nation's Capital,* prepared for the Thirteenth Meeting A.N.Z.A.A.S., Canberra, 1954, pp. 209-220. Other urban studies of Australia hitherto published are those of the American geographer C. M. Zierer. See, *inter alia,* 'Broken Hill: Australia's Greatest Mining Camp', *Ann. Assoc. Amer. Geogrs.,* Vol. 30, No. 2, June 1940, pp. 83-108; 'Melbourne as a Functional Centre', *ibid.,* Vol. 31, No. 4, December 1941, pp. 241-288; 'Brisbane: River Metropolis of Queensland', *Econ. Geography,* Vol. 17, No. 4, October 1941, pp. 325-344; 'Land Use Differentiation in Sydney, Australia', *Ann. Assoc. Amer. Geogrs.,* Vol. 32, No. 3, September 1942, pp. 255-308; and 'Aspects of Urban and Industrial Geography in Tasmania', *Sci. Monthly,* Vol. 53, July-Dec. 1941, pp. 325-345.

[5] A. D. Tweedie: 'Sugar Cane in Queensland', *N.Z. Geographer,* Vol. 9, No. 2, October 1953, pp. 125-143.

[6] D. S. Simonett: 'Climate and Cattle Production in North Australia (Cairns-Normanton)', *Australian Geographer,* Vol. 6, No. 2, March 1953, pp. 15-24.

Simonett considers in detail the relationship between effective rainfall and pasture growth, together with associated farming problems. Particular attention is paid to the amount and nature of rainfall necessary to promote pasture growth during the cooler period from May to September and during the hot dry season from October to April. The discussion of effective rainfall is based on the judgement of local graziers rather than on the use of P/E indices which the author distrusts for this area. An attempt is made to substantiate generalisations made between the length of a wet season and mortality rates in the following dry season by using estimated statistics from only two stations over a period of ten seasons. Cattle statistics, the author says, are quite unreliable.

In order to save cattle during droughts, Simonett argues, supplementary feeding must be introduced. He suggests the growing of forage sorghum and drought-tolerant millets, and the 'green haying of natural pastures'. Areas with soils suitable for such cultivation are shown on a map. Both Simonett, for his map of soils, and Tweedie, for his land-use map, appear to have relied heavily on maps published in January and May 1949 by the Queensland Bureau of Investigation.

Agriculture and Irrigation

Shaw's article, the final paper of the group, is concerned with irrigated agriculture in part of the Central Murray area of New South Wales.[7] The author briefly surveys stages in the rural development of the Deniliquin region, emphasising the tremendous changes that have taken place in the character of the area since 1935 when irrigation was first undertaken in the Wakool district. Wheat growing and grazing became relatively less significant, whilst fat-lamb raising and dairying assumed much greater importance.

The tendency in recent years has been to concentrate on fat-lamb and mutton raising, using irrigated pastures. Assured water supplies within the area have resulted in changed land use, closer settlement, and an increasing development of tertiary industries to meet the growing demands of a stable and prosperous community. Shaw draws attention to the youth of the irrigation schemes within the area and to the problems that have impeded development. Considerable emphasis is placed on the definition of terms, and on the mechanics and economics of irrigation. The characteristics of the Wakool, Berriquin and Denimein irrigation districts are described. Mention is made of Deniboota where irrigation has not yet commenced.

Nowhere is the Deniliquin region clearly defined and the reader turning to the map for help will be confused only further by its title 'Land Use in Central Murray'. Added to this, two of the four irrigation districts mentioned are not located on the map. The map differentiates areas on the basis of function almost to the exclusion of form, and like so many 'land-use' maps it tends to be merely a portrayal of agricultural practices.

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[7] J. H. Shaw: 'Land use in the Deniliquin Region', *Australian Geographer,* Vol. 6, No. 2, March 1953, pp. 31-37.

Changing Emphasis

During recent years studies in many aspects of the physical geography of Australia have become relatively less numerous.[8] Little work has been attempted in some branches of systematic cultural geography, and the position over the last three or four years has not improved. Studies in agricultural geography, often of a utilitarian nature and very often in relation to some climatic problem, have always been popular. Whilst the six papers reviewed provide a worthwhile contribution to Australian geographical literature, they do tend to underline this characteristic.[9] In addition they indicate that other types of studies are becoming more important and that Spate's wish for a more balanced geography[10] is in some small way being met—at least so far as one can judge from the short series embraced by this review.

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[8] This is especially the case with geomorphology, pedogeography and the geography of vegetation.

[9] The consideration of such papers as Greenwood's assessment of the field of economic geography, Spate's inaugural address and the same author's work on New Guinea does not fall within the scope of this review. See R. H. Greenwood: 'The Economic Aspects of Geography', *Australian Geographer,* Vol. 6, No. 1, June 1952, pp. 17-21; O. H. K. Spate: *The Compass of Geography,* Canberra, 1953; and *idem:* 'Changing Native Agriculture in New Guinea', Vol. 43, No. 2, April 1953, pp. 151-172.

[10] Spate: *The Compass of Geography,* p. 7.

GEOGRAPHIC NOTEBOOK

CONTRIBUTORS TO THIS ISSUE. Among the authors of articles in this number of the *New Zealand Geographer* are two who make contributions for the first time. Mr. P. N. D. Pirie describes some of the salient characteristics of a part of inland Hawkes Bay which he aptly names the 'pastoral fringe'. The present article is a summary of part of a thesis presented for a master's degree in the University of New Zealand, fieldwork for which was undertaken in 1952 and 1953. Mr. Pirie received his geographical training at Victoria University College and, latterly, at Auckland University College, and at present he is pursuing postgraduate studies at Auckland Teachers' College.

Mr. J. U. Macaulay's contribution also represents a summarisation of part of a thesis—in this case that part concerned with methodology. As a student in the Department of Geography, University of Otago, Mr. Macaulay spent several months in the field investigating the nature and extent of the Oamaru tributary region. His master's thesis was presented in 1951, and after two years at the Teachers' College in Dunedin, he has been appointed to the post of geography master at Papakura High School.

Mr. L. P. Lee contributed to the pages of the *New Zealand Geographer* on a previous occasion (Volume 3, No. 1, pp. 41-58) when he discussed the properties of the equidistant azimuthal projection and set out the necessary computations. This he has done again for the oblique Mercator projection. Mr. Lee is a staff member of the Computing Branch of the Department of Lands and Survey, and the quality of his work is well known beyond New Zealand shores. The New Zealand Geographical Society welcomes the opportunity to publish the work of so eminent a contributor in this very specialised field.

The work of Mr. Murray McCaskill has long been highly regarded among geographers in this country. A former student, and now a member of the staff, of the Department of Geography, Canterbury University College, Mr. McCaskill has for several years been actively occupied on a doctoral thesis, and the present article is an outcome of part of his research in Westland. Recently he left New Zealand for England where he will occupy temporarily a post in the Department of Geography at University College, London.

In this issue the pedagogic article has been written by Mr. James W. Fox, Senior Lecturer in Geography at Auckland University College. Before his arrival in New Zealand, Mr. Fox taught geography in all types of school in England, and since then he has maintained contact with his former profession through teachers' groups and examining at all levels. His observations will no doubt rouse ire among teachers of geography throughout the dominion, but if such ire brings in its train self-examination, Mr. Fox will have, in some degree, made his point. Lethargy and complacency are the greatest enemies of efficient teaching.

Other contributors to this number include Mr. Bryan H. Farrell, Lecturer in Geography at Auckland University College, who has written a review article on geography in Australia; Professor J. F. Northey, Mr. L. Curry, Mr. S. S. Cameron and Mr. R. R. Nayacakalau of Auckland University College; Miss Rilda Gorrie and Mr. A. R. Harvey of Auckland Teachers' College; Mr. K. B. Radford of Auckland

Grammar School; Mr. W. B. Johnston and Mr. W. P. Packard of Canterbury University College; and the editors.

PROGRESS IN WESTERN SAMOA. The annual report on Western Samoa shows clearly that during 1953 the New Zealand administration applied itself conscientiously to the problems facing the political, social and economic betterment of the Samoans. This is apparent, for example, in the improvement of medical facilities, the extension of educational institutions (notably the official opening in 1953 of the Samoa College at Apia), the developments in political structure, the beginning of cooperatives, and the encouragement of basic surveys of land, demography, labour and economy which are largely being carried out in cooperation with the South Pacific Commission.

Yet this enlarged report, which contains a wealth of detailed information for scientists in many fields, is not overoptimistic, and, in contrast with earlier reports, repeatedly returns to certain critical aspects. The fundamental problem of the trust territory arises out of the interrelationships of three outstanding features: first, the rapid increase in population; second, the traditional system of land use based on the extended family (*aiga*) and organised by its head (the *matai*), a system basically of subsistence agriculture with a partial graft of a commercial cultivation; and third, the importance to the economy of a narrow range of agricultural exports.

With regard to exports one may wonder why the report finds little to worry about because New Zealand can take more bananas than Western Samoa can produce; because the long-term contract for copra with the British Ministry of Food has 'still four years to run'; and because the world market for cocoa shows 'no signs of serious depression'. As for population and land use, 'there is evidence that in recent years *per capita* production has tended slowly to decrease while population continues to rise. . . . '. While high postwar prices for agricultural exports have shielded the economy, the population problem has remained crucial for Samoa's future.

TABLE I

POPULATION OF WESTERN SAMOA

Year	Population	Year	Population
1900	32,875*	1926	40,229
1902	32,612*	1936	55,946
1906	37,320	1945	68,197
1911	38,084	1951	84,909
1921	37,157		

*Indigenous inhabitants only.

The growth of population is indicated by figures in the report taken from various censuses (Table I). The rate of growth over the last thirty years is most striking. Statistics also show that the age structure of the population is youthful, and a doubling of the population within twenty-one years is predicted. (In the report of 1950 the period required was set at twenty-five years.)

Land use is vividly illustrated in Tables II and III.

TABLE II

ACREAGE OF SAMOAN VILLAGE LAND UNDER ALL CROPS

District	Bananas	Coconuts	Cocoa	Taro	Minor Crops	Total	Population
Upolu Northwest	1,058	1,194	1,753	77	124	4,206	14,766
Upolu Southwest	4,589	5,150	494	606	202	11,041	7,375
Upolu Northeast	1,524	1,148	80	159	160	3,071	4,798
Upolu East	2,241	11,069	810	718	350	15,188	7,871
Western Savai'i	1,593	5,605	2,880	1,603	1,571	13,252	6,899
Eastern Savai'i	2,228	11,361	1,924	1,288	1,487	18,288	16,951
Apia Township	93	515	85	192	191	1,076	20,916
Total	13,326	36,042	8,026	4,643	4,085	66,122	79,576
As Percentage of Total Acreage	20.2	54.5	12.1	7.0	6.2	..	..

TABLE III

ACREAGE OF LAND OTHER THAN SAMOAN VILLAGES UNDER MAIN CROPS

Type of Holding	Bananas	Coconuts	Cocoa	Taro
Plantations	340	1,285	2,800	55
Mission Stations*	145	221	86	105
N.Z. Reparation Estates	309	7,745	1,850	..
Total	794	9,251	4,736	160

*Figures incomplete.

It is clear from these figures, which were collected for the Agricultural Census of 1951 as part of the World Census of Agriculture, that in northeast and northwest Upolu, which include the main urban centre of Apia, the relation of population and land use is more critical than elsewhere. Further, the areal dominance of native subsistence and native commercial (village) agriculture over plantation agriculture is apparent. This feature has been emphasised in recent years by the administration's purchases for the Samoans of large areas of the New Zealand Reparation Estates; in 1952 some 42,000 acres were thus acquired. This is a feature of another table in the report. (See Table IV.)

Thus less than one sixth of the total area is under cultivation, and since no complete resource survey has been undertaken it is not known what areas at present unused are capable of being brought into production. Calculations show that, although there are only eighty-one persons per square mile of total area, there are 469 persons per square mile of cultivated land. Further it is noteworthy that regional densities reach very high figures; for example, over 1,000 persons per square mile of cropped land in Upolu Northwest and a figure of almost 1,000 in Upolu Northeast. Even allowing for the necessary margin of error arising from the method of collecting the statistics there is little doubt that the rapid increases in population pose critical problems.

TABLE IV

LAND USE IN WESTERN SAMOA

1. Land under Cultivation or used as Building Sites, etc.	Acres	Acres
N.Z. Reparation Estates (freehold)	12,900	
N.Z. Reparation Estates (leased Samoan land)	400	
Samoans	76,000	
European (leased from N.Z. Reparation Estates)	7,900	
Samoan Government, European and Missions	27,050	124,250
2. Rainforest, Reserves, and Uncultivated Land		
N.Z. Reparation Estates	17,000	
Samoan Government	72,150	
Europeans and Missions	6,050	
Samoans	460,550	
Lava fields on Savai'i held mainly by Samoans.	45,000	600,750
	Total	725,000

Faced with this population growth the report states that 'it is doubtful whether the old social system, which is . . . the basis of the economy, . . . can be expected, at least in its present form, to undertake successfully the major development of agriculture and other basic production [that is necessary] if the standard of living is not to be seriously lowered'. The role of land tenure is an important factor here and the review of the history of land tenure shows clearly that any attempt to introduce a system of direct inheritance of land is almost certain to fail because of the lack of Samoan cooperation. However, two important tendencies are noted: first, that of the actual control of land to become localised in those groups cultivating it, replacing the traditional overall control of the *matai*—a feature which is far more pronounced than any movement towards the individualisation of land titles; and second, the increasing number of Samoans who are establishing larger, better-organised and better-managed plantations comparable with those of the Europeans.

Two other points are worthy of comment. The friction of a plural society appears to be decreasing with the trend for part-Samoans of European status to intermarry with Samoans or near-Samoans. Finally, in view of what the reviewer has seen of the islands and what is contained in the *Report of the Forest Survey of 1950*, which is referred to in the report, it is difficult to agree with the statement that 'inland, erosion is unknown'.—W. B. JOHNSTON

THE EIGHTH NEW ZEALAND SCIENCE CONGRESS. The Eighth New Zealand Science Congress of the Royal Society of New Zealand was held at Auckland University College in May this year. The New Zealand Geographical Society was one of the twenty-five scientific societies which participated in the congress. In Section F, Geographical Sciences, one day was devoted to the presentation of five miscellaneous papers, while most of two days was taken up by symposia in which discussions in aspects of geography and cognate fields took place.

The section programme commenced with an address by the chairman of the section, Mr. R. G. Lister of the University of Otago. His subject was 'Rural Settlement in Southland and Canterbury'. This paper, which at a later date will be published in full in the proceedings of the congress, presented various aspects of the form and character of representative settlements in two areas of the South Island. Examples of settlements and important house types were illustrated with colour slides. This contribution to the geography of settlement represents an initial step in a new field of geographical research in New Zealand.

In a paper entitled 'Contrasting Policies of Early Settlement in Northland and Central Otago', Mary B. Kibblewhite drew attention to the differences in the character of settlement between these two areas during the 1850's. Settlers outside the Otago Block held large sheep runs which covered much of the interior of the province, population was sparse, communications were inadequate, and few villages or towns existed. Northland, on the other hand, was characterised by an increasing agricultural settlement around mission stations, by trade with a large Maori population, by a fairly self-sufficient economy based partly on timber milling and the revictualling of whaling vessels, and by a strongly-nucleated pattern of population with its main centres on the coast. There were contrasts as well marked in the manner of land tenure and in the character of the population pattern that eventually came with the discovery of gold and the exploitation of kauri gum.

James W. Fox presented a paper, 'Land-use Classification and Survey' in which he pointed out the serious confusion now existing in the meaning of land use. He defined land use as 'the present use of the land in terms of its inherent characteristics', emphasised that form and not function constituted the basic criterion of classification, and that land use was not synonymous with agriculture or land classification. The speaker then went on to explain logically his particular classification devised for New Zealand conditions. He also indicated that this classification, which had been constantly revised over several years, had now reached a stage when it could be published in full to provide the basis for a dominion-wide survey and to make a contribution to the World Land-Use Survey envisaged by the International Geographical Union.

William H. Wallace spoke on some aspects of railways in Northland, while L. L. Pownall's paper was entitled 'The Historical Evolution of the Urban Hierarchy in New Zealand'. Mr. Wallace emphasised the dominating position of Auckland in the pattern of railway operation, the low traffic densities on the Northland system, the significance of cattle shipments from stations, and the relative insignificance of rail passenger transport compared with other means of travel. Mr. Pownall recognised in New Zealand four separate classes of urban areas differentiated on the basis of size. These were major cities, cities, major towns and towns. This system of ranking could not be understood unless history of urban development was known and to this purpose seven development periods were postulated. The 'urban revolution' of

1902-1911 was probably the most important period in the urban history of New Zealand, for at this period emerged a full urban hierarchy with major towns represented for the first time.

The two most important symposia were 'Climate and Agriculture' and 'The Problems of Greater Auckland'. In the first symposium, papers were given on evaporation in New Zealand, soil temperatures, solar radiation, water-table level and summer pasture production, and the effects of climate on fruit growing. Leslie Curry, the only geographer contributing to this symposium, dealt with some of the problems associated with his research, and the conclusions he had reached so far in his work on climate and pasture growth. In the second symposium, Professor K. B. Cumberland acted as chairman and Mr. F. W. O. Jones outlined the many problems associated with the growth of Greater Auckland, Dr. R. G. McElroy discussed urban sprawl, and Professor C. R. Knight presented the paper, 'Town Planning within the Urban Fence'.

Papers of interest to geographers in other sections of the congress included the role of forestry in the land-use pattern of the West Coast by D. Kennedy, urbanisation and the pattern of Maori life by A. J. Metge, the planetary circulation of the earth's atmosphere by J. W. Hutchins, the development of agriculture in New Zealand in relation to population by J. V. White, methods of research in the social sciences by Professor J. Rutherford, and the symposia on, first, the impact of substitute foods and fibres on New Zealand's primary industries and, second, geothermal power developments.

Except for those giving papers, the attendance of geographers from outside Auckland was rather disappointing. It is hoped that greater support will be forthcoming in September 1955 when the New Zealand Geographical Society will hold in Auckland its first Geographical Conference. A broad programme will be arranged to suit all interests, and papers will be welcomed, especially from graduates in geography and teachers of the subject who would like to express their ideas and opinions. A committee has been formed comprising Mr. K. Radford of Auckland Grammar School, Mr. N. H. Whatman of Ardmore Teachers' College, and Mr. B. H. Farrell of Auckland University College, who is also convener of the committee. This first New Zealand geographical conference deserves every success. A ready response and a good attendance by geographers throughout New Zealand will encourage the New Zealand Geographical Society to organise such meetings which cannot fail to benefit geography and geography teaching.—BRYAN H. FARRELL

THE JUBILEE OF THE GEOGRAPHICAL ASSOCIATION. The year 1953 marked the Diamond Jubilee of the Geographical Association in Great Britain, and the occasion was commemorated by a conference at Cambridge at which addresses were given by such well-known geographers as F. Debenham, T. C. Warrington, H. J. Fleure and C. J. R. Howarth (*Geography*, Vol. 38, Part 4, November 1953). Professor Debenham, the immediate Past President, gave a personal account of his early interest in the subject, inspired, as is so often the case, not by formal teaching, but by travel and contact with a layman who had a curiosity about places. He pointed out that it was Mackinder who first called geography largely an attitude of mind, and described his trips in Australian waters on a tiny cattle boat with a mate who had a proper attitude to geography, and whose curiosity about places was accompanied by a love of explanation which thrilled the young Debenham. For such as he, the non-academic geographer, Professor Debenham used the happy expression 'instinctive geographer'. New Zealand will recall the great number of such men in her own short history—explorers such as Heaphy, geologists of the calibre of Hochstetter, or settlers like Guthrie-Smith at Tutira. The present-day professional geographer regrets the passing of such people, for their like is apparently no more.

Mr. Warrington outlined the beginnings and development of the Geographical Association, and showed how it reflected the growth of the subject in Britain—a point also evinced in the changing ideas embodied in school textbooks. New Zealanders will perhaps remember one text which he quoted, T. H. Huxley's *Physiography,* published in 1880, which was highly commended by the early inspectorate in this country. Mr. Warrington recalled also the phases through which geography has passed during the last eighty years, expressing a faint lingering affection for the 'capes and bays' geography of the 'nineties and early nineteen-hundreds, but admitting that perhaps he was fortunate in his teachers. It is certainly true that today, when school children of all ages have so nebulous an idea of location geography, putting Berlin in Brazil, and New York in the Argentine, many people who were exposed to the 'capes and bays' style of teaching are inclined to defend it in retrospect, forgetting, of course, that the modern youngsters' lack of location knowledge is by no means an inevitable attribute of new concepts, but is an expression of downright bad teaching.

Of interest too, is the mention of early teachers such as B. B. Dickinson of Rugby, who first in Great Britain tackled the problem of classroom illustrations. The ghost of this enthusiastic user of visual aids must haunt many a New Zealand classroom today, bewailing the comparative or complete neglect of many modern devices.

Dr. O. J. R. Howarth's survey of the present position of geography in English schools might, in many respects, be a description of the situation in New Zealand. It appears that there is in England the same need as here to urge local geography upon teachers as an indispensable part of the work, because it alone can provide the basis of experience from which all other geographical work proceeds. In one respect the work of English primary school geography is well ahead of the New Zealand counterpart, for there maps on scales of six and of twenty-five inches to the mile are available. Perhaps if these were to be had in New Zealand teachers would rid themselves of the idea that the reading of topographic maps is beyond the capabilities of children in Standards III and IV. As Dr. Howarth put it; 'they quickly grasp their use and significance, and once affection for a map is established in a child's mind it remains with him, probably through life'.

It is interesting to read that at junior levels film strip projectors are coming rapidly into wide use. This is a good thing. There is no more useful everyday visual device. In New Zealand, film strips are cheap to hire or to buy, and the range of films from the National Visual Aid Library alone is extensive. Children can so easily themselves use the machine without fear of breaking it or damaging the film. It is noteworthy that in the lower forms of English secondary schools geography is taught for only two or three periods a week, but in the higher forms there is a wide variation from school to school in the time devoted to the subject. Dr. Howarth remarked that there is frequently little opportunity for practical work. That comment has a most familiar ring, as has his further statement that the really well-equipped geography room was exceptional.

All geographers will be glad to know that the idea that geography is a soft option is dying slowly, and 'were better dead'. Grammar schools today provide it as a main subject. It is true that in New Zealand at the university level geography is not regarded as a soft option, but pertinent to the whole issue one could remark that the brightest academic post-primary pupils do not seem to be encouraged to make geography their main subject.

Dr. Howarth had something to say also about Social Studies as conceived for, and practised in, English schools, mainly the secondary modern schools. It must be remembered that Social Studies there is not exactly the same thing as it is in New Zealand, and that in this respect the English schools are going through a confused period comparable with that from which most New Zealand post-primary schools have now emerged. Speaking of Social Studies in England he said: 'A school subject recently developed under the title of Social Studies is held, with good reason, to assault the adequate teaching of geography, as well as history and possibly other subjects. It is not difficult to understand the favour with which studies offering a broad superficial outlook may be regarded; but the present writer has some reason to suppose that the earlier enthusiasm for them does not maintain itself.' It is true that many of the early and still existing Social Studies syllabi of certain secondary modern schools are diffuse and superficial in content. It is however fair to say that they do not have to be, and some appear, on paper at least, to be admirable courses. At all events it would appear that in England, as in New Zealand, Social Studies has forced geography to defend itself. If this be accompanied by reform in the modernising of method and of concepts, Social Studies was not created in vain.

—Rilda Gorrie

IN OUR CONTEMPORARIES

In Overseas Journals . . .

Racial Problems in Fiji

FIJI: COLONY IN TRANSITION: Ronald Gatty, *Pacific Affairs,* Vol. 26, No. 2, June 1953, pp. 118-130.

The human geography of the Fiji Islands is an interesting, if not a fascinating, field of study to the geographer who is aware of the dramatic changes taking place in the way of life of island peoples in the Southwest Pacific. Ronald Gatty, in this all-too-brief twelve-page article, has undertaken a very useful and stimulating objective analysis of some of the internal problems of Fiji. Many of these social, economic and political difficulties are rightly assessed as 'the products of its "plural" society'. It is not surprising to find that the Indian and Fijian problems are fundamentally different. In the Fijian communities the increasing disorganisation and disintegration of native life under the impact of alien cultures is the chief cause for concern, whereas in the Indian community there is division internally by social, political and economic factors, manifest particularly in the pressing Indian grievances against existing laws of land tenure. The writer justifiably places emphasis on the fact that the Indian problem is basically economic rather than social or political.

Some consideration is given to current government aims and practices in combatting these problems, together with an enlightening explanation of the difficulties which face the administrators in the implementing of legislation. Mr. Gatty offers no particular criticism of these policies, but he is equally noncommittal in his evaluation of any apparent results of government programmes. The rapid rate of crystallisation of the problems since 1920 suggests that more aggressive government action is called for, especially when thought is given to possible results from the social isolation of racial groups in the colony. Undoubtedly the handling of the major issues requires great delicacy and one must agree with the writer that 'the achievement of a sound agricultural system and a culturally compatible society will be neither quick nor easy.'

The article is introduced by a concise summary of the history of European settlement in Fiji. The European population today is seen as 'temporarily resident rather than permanently settled—a salaried minority'. It is apparently assumed that the very considerable importance of Australian enterprise and British administration in Fijian affairs is fully appreciated. Then follows an equally-balanced analysis of Fijian and Indian problems. Relative to the Fijians, explanations are given for the increasing number of Fijians living away from the village, the declining power of the chiefs, and the difficulties facing the new commercial peasant farmers (*dauteitei*). A somewhat fuller account is given of the Fijian custom of *kerekere,* 'a useful kind of social security that reinforced ties of kinship and community, but today works against the new economy and retards the Fijians' commercial progress'. A keen appraisal of the Indian question is then developed. The author regards the political problems as more serious than those of a social nature. The Indians undoubtedly look to India for leadership and support, and have only a very limited representation on the

Legislative Council although they are the largest racial group in Fiji. The pressing economic problems have been given most emphasis, particularly the Indian grievances concerning land tenure. Mr. Gatty suggests the situation will improve as reserves are established and surplus native land becomes available for lease to farmers who will have also security of tenure. There is cause for concern, though, in the slow progress of the Native Reserves Commission.

It is a pity that limitations of space and an unwillingness to be forthright have prevented a fuller treatment of problems which have been given only brief mention. Nevertheless this article is a valuable contribution to the limited literature on the internal problems of Fiji.—A. R. Harvey

The Impact of Asia

NEW ZEALAND FACES NORTH: W. F. Monk, *Pacific Affairs,* Vol. 26, No. 3, September 1953, pp. 220-229.

The author, who at the time the article was written was Senior Lecturer in History at Victoria University College, was recently killed in tragic circumstances while en route to a conference in Pakistan. The late Mr. Monk deals with the changes in the international situation in the Pacific since the analysis made by Professor F. L. W. Wood in 1949 ('Report from New Zealand', *Pacific Affairs,* Vol. 22, No. 1, March 1949, p. 34). These changes have made us conscious of the importance of developments in Asia. But having accepted the fact that we can no longer ignore what is happening in Asia, are we prepared to meet the new situation by modifying our policies accordingly?

We have seen the shifting of world tension from Europe to Asia, the initiation and operation of the Colombo Plan, the conclusion of a 'soft' treaty with Japan, the making of security agreements with the United States by some of the Pacific powers, and the closing of Japan's natural markets in China and her success in winning new markets at the expense of western countries. Although the full implications for New Zealand of these events are not generally appreciated, we do have a clearer picture of the future than we had in 1949 when New Zealanders were beginning to accept the fact that they had fallen into the United States political sphere. The degree of our dependence on the United Kingdom and its effects on our traditional association with the mother country are shown by the composition and decisions of the Anzus Council. The dangers implicit in the new situation were demonstrated in Korea, and the likelihood of our being committed to some form of intervention in Indochina is very real. It can no longer be assumed that our primary military responsibility is the defence of the Middle East.

We have been forced to abandon our postwar policy directed against a revival of an aggressive Japan and to face the problem of Communism in Asia. The 'Danegeld expedient' of the Colombo Plan is obviously inadequate, but there is an unwillingness to consider any more satisfactory alternative. Increased trade with Asia and especially Japan, although recognised as desirable, runs contrary to our policy of protecting local industry and living standards. Although protection has been partially abandoned by the present government, it is realised that the interests of New Zealand manufacturers and their employees must be safeguarded. Nor is there any possibility of any change in immigration policies which continue to be directed towards the entry of only selected European immigrants, and then only in such numbers as can be absorbed without lowering living standards.

Mr. Monk offers us two alternatives, both of which will involve economic sacrifices and a reduction of living standards. First, we could abandon our claims to a privileged European outpost and accept the consequences of free immigration and trade. Free immigration from Asia to New Zealand would contribute to the solution of Asian difficulties. Second, we could build up an association with Australia and the United States, a powerful entity in the South Pacific capable of resisting, by force if necessary, claims by Asia to share in our prosperity. If these are the only alternatives, the decision on our future policy cannot be delayed much longer.

—J. F. Northey

Climate and Pedogenesis in New Zealand

CLIMATES PREVAILING IN THE YELLOW-GREY EARTH AND YELLOW-BROWN EARTH ZONES IN NEW ZEALAND: F. B. Hurst, *Soil Science,* Vol. 72, No. 1, July 1951, pp. 1-19.

The yellow-brown and yellow-grey earths are the most important zonal soils of New Zealand from the points of view of both areal extent and agricultural significance. They overlie many types of rocks of differing age and composition in areas with marked variations in surface configuration. The first important difference between yellow-brown and yellow-grey earths is that the former are more leached of their basic constituents and are thus more acid, base saturation increasing with depth in the case of the latter and decreasing in the former. Yellow-brown earths are richer in organic matter, and therefore of nitrogen, in the first foot of the soil. Yellow-grey earths show cracking of the subsoil.

Miss Hurst believes that the climate has caused these differences and has attempted to describe the climate in quantitative terms in order to bring out the functional relation between climate and soil type. An assessment of climate as a factor in pedogenesis must take account of the climatic factors which affect: (a) vegetative growth and thus the addition of organic matter to the soil; (b) the degree of chemical and microbiological activity in the soil; (c) the percolation of gravitational water through the soil and thus the amount of leaching; (d) the degree and type of physical weathering of the soil. This is asking a lot of the climatologist, and so far nobody has offered a complete answer.

Meyer's ratio [Monthly Rainfall/Monthly Saturation Deficit] can define a 'dry month' and so give a leaching factor. The author is mistaken, this reviewer believes, in saying that such a factor is more than empirical. She finds no clear climatic differentiation between soil groups using this formula. Prescott's modification of Meyer [Annual Rainfall/258 . Saturation Deficit (in inches of mercury)] has an identical purpose and gives a better differentiation. However, following Prescott, values of the index corresponding to the yellow-grey earths should show no leaching, which is, of course, incorrect. But the main reason for rejecting this formula is that it takes no account of seasonal variations. Crowther's leaching factor [Annual Rainfall + 24 — $\frac{3}{4}$ Mean Annual Temperature] is also unreliable.

Thornthwaite's 1931 formula [Monthly Rainfall — Monthly Evaporation = 115 Monthly Rainfall/(Monthly Temperature — 10)] also gives a leaching factor. The author discards it on the grounds that, while giving an idea of the length of time in which leaching takes place, it cannot give a numerical value for leaching throughout the year. Thornthwaite's 1948 formula, by supplying a measure of both the periods and quantities of soil moisture deficit and surplus, gives a leaching factor and an indication of the extent to which subsoil cracking can occur. The author finds that this formula gives the best correlation with the distribution of the soil types under consideration. A water surplus of under nine inches is found to give yellow-grey earths, one of nine to twenty inches gives transitional yellow-grey to yellow-brown earths, and a surplus of twenty to sixty inches gives yellow-brown earths.

It is unfortunate that the author did not calculate the time during which the soil loses its gravitational and capillary moisture—the period when it is most likely to crack. This could be done from the Thornthwaite's system of 1948. Nor is the nitrogen balance investigated. But these are tasks which can now be undertaken by others who care to follow this stimulating work which pioneers a quantitative functional approach to the soil climates of New Zealand.—L. CURRY

REVIEWS

A New Zealand Classic

TUTIRA : THE STORY OF A NEW ZEALAND SHEEP STATION. By H. Guthrie-Smith. Edinburgh: W. Blackwood and Sons Ltd., 1953 (Third Edition), pp. 444.

The reappearance of H. Guthrie-Smith's story of the development of Tutira is an event in many quarters. It is highly regarded as an important contribution to New Zealand history and to New Zealand literature, and although written by an amateur, it adds to our knowledge of the geology, geomorphology, botany and ornithology of New Zealand. To geography, however, its increasing worth as a graphic, meticulous account of the changes which took place on 60,000 acres in Hawkes Bay during New Zealand's first century has perhaps not been adequately recognised. The book first appeared in 1921 and a second edition followed in 1926. Today, these editions are priced beyond the range of the ordinary reader. The third edition, revised and brought up to date by Guthrie-Smith before his death in 1940, has now been published.

In developing Tutira, Guthrie-Smith faced many problems, not the least among them that of slipping: 'From the edges of all ancient slips the water-sodden fringes drip with clay; new red-raw wounds smear the green slopes, scalp-shaped patches detach themselves, slipping downward in slush and turf. Sometimes a whole hillside will wrinkle and slide like snow melting off a roof, its huge corrugations smothering and smashing the wretched sheep, half or wholly burying them in every posture. . . .' Excessive rainfall was another problem. Guthrie-Smith describes it as 'the bane of the place, retarding its development for years'.

To the geographer, the most fascinating parts of the book are the accounts of the subjugation of the original vegetation, of the series of attempts to farm the station, ending with Guthrie-Smith's successful efforts, and of the later vicissitudes of this intrepid pioneer. The chapter on fern-crushing is a particularly valuable account of the methods used by pioneers to create pasture, and the claim that 'on the bulk of its twenty thousand acres, it is no exaggeration to say that the surface had to be stamped, jammed, hauled, murdered into grass' is fitting tribute to the toil and sweat that went into the fashioning of Tutira farmlands. Unfortunately, the effects of this struggle are still evident in the large area of thin burnt-out soils, and in the serious soil erosion on the steeper country.

Guthrie-Smith records, step by step, the changes which took place on Tutira, and concludes with a definite suggestion that the story of this one sheep station has wider implications. It is more than a detailed pioneer story—it is the story of Hawkes Bay and of New Zealand. Guthrie-Smith ends with this assurance to his readers: 'If every chapter has been read, unflinchingly, they can rest assured that in examination, as it were, under a microscope, of one sheep station, they have discovered what is to be found in all. . . . There is nothing very exceptional in the little bit of land about which [I have] written. . . . Every station . . . has been moulded by a great rainfall; possesses legends and relics of a splendid aboriginal race; has been clothed with forest, flax and fern; has been subdued by pioneers in desperate straits for cash and credit; has been overrun by an alien vegetation and alien beasts; has righted its equilibrium; has had its surface mapped by stock, its rivers affected by scour, and, lastly, has been, or is in the process of being, subdivided into smaller holdings.'

Guthrie-Smith saw the decline of the 'squatters' as a class to which he himself belonged, and the rise of the 'yeoman farmer', his rather grand term for the New Zealand 'cocky'. Tutira was subdivided after the first World War into fourteen smaller farms, leaving Tutira Station with about 7,000 acres. Today, after further subdivision, only 2000 acres remain, farmed as the 'Guthrie-Smith Trust', on two sides of the lake which is now a bird sanctuary. The land which remains to the station has been badly burnt out, and today the natural fertility of the rugged sheep country, which Guthrie-Smith prized above the now fertile pumice lowlands, is very low. Seven hundred acres remain in manuka scrub, but almost 300 of these are so badly damaged by fire and erosion that they will probably never be suitable for pasture. Soil erosion, which damaged the station very seriously in 1938, has been arrested by the improvement of pastures, particularly by increased phosphate topdressing, and the damage is now mostly healed. The property is divided into twenty-five paddocks ranging from two to five hundred acres in size. It is noticeably well-planted with trees, particularly around the lake, and a wide variety of English and native trees, which were Guthrie-Smith's particular joy, remain. Insignis pine, eucalypts and macrocarpas, the usual trees now found in this area are also present. The station now carries 1600 sheep, 350 run cattle, thirty milking Jerseys and some pigs. Once 30,000 sheep grazed on Tutira.

Tutira remains as typical of northern Hawkes Bay today as it was in Guthrie-Smith's time. It has shared in the change to dairying on the rolling pumice country, aerial topdressing has been adopted enthusiastically, and manuka blight is present in its scrub. New pasture is being put down at the rate of about 100 acres a year to replace the worn-out swards originally created by Guthrie-Smith. The station owns a tractor and a good range of implements. As a farm, Tutira is rapidly improving, as are the other farms which now occupy Tutira land, and the processes of land development which are the main interest in *Tutira* still continue. Of those processes Guthrie-Smith said: 'Some interests pass with passing years; one never palls—the development of land'. His interest is today shared by a community of farmers not only in Hawkes Bay, but in New Zealand generally. Primary production is the lifeblood of this country's economy, and its efficiency today owes much to men such as Guthrie-Smith, pioneer, visionary, practical farmer and able chronicler.

—P. N. D. Pirie

Inventory and Prospect in Melanesia

SOCIAL ANTHROPOLOGY IN MELANESIA. By A. P. Elkin. Melbourne: Oxford University Press, 1953, pp. 166.

A better choice could hardly have been made than Professor Elkin for the authorship of this volume dealing with the results and requirements of anthropological research in a vast territory containing nearly two million inhabitants. Not only has he had a close association with anthropological research in the area, but he has also been concerned with practical problems there.

The author begins with a systematic evaluation of the different types of information contained in the existing literature on the area. He points out that the contributions of explorers and travellers, of missionaries, administrators and of settlers may at times be of considerable anthropological value. Some of these writers have been historians or scientists who have selected their material according to its scientific worth. Often the descriptive material is such that it can be used by anthropologists for comparative analysis interregionally and through time. The contributions of trained anthropologists are first considered according to methods of approach. Contributions largely concerned with the collection of data include some of the works of Haddon, Seligman, Rivers and others whose investigations were ushered in by the Cambridge Expedition to the Torres Straits in 1899. These investigations were considered superficial by later writers, who adopted the functional type of detailed analysis developed by Malinowski. Important contributions along these lines were made by Firth, Fortune, Bateson, Mead and Blackwood. Later the functional approach was supplemented by a diachronic approach. In this latter category are the works of F. E. Williams, and H. I. Hogbin's *Experiments in Civilisation*. Making use of history and psychology, they seek to establish the causes and courses of culture change through time. In view of the proven value of this type of investigation, Professor Elkin urges the return of anthropologists to their previous fields of research to study the problem of 'social and cultural change in all its aspects'.

The next section of the book makes it a basic text for all persons concerned with research in Melanesia. It comprises a thoroughgoing survey of anthropological literature on the whole region, area by area, covering works by all types of authors from the nineteenth century to the present day. The bibliographical references are very full. The problems considered include those concerned with administration, missionary activity, medical services, education, culture contact, depopulation, nativistic movements and economic development.

In view of the magnitude of the task confronting the 'practical man' in the area, and of the shortage of anthropological personnel who can be available for detailed sociological studies, the author recommends coordinated studies organised by a central anthropological research body working to certain principles and plans. The two main guiding principles are that vigorous sampling should be adopted in the selection of areas for study, and that adequate linguistic ability should be required from research workers to ensure thorough study of the symbolic and psychological aspects of the cultures. At the end of the book a final plan is presented classifying problems for research in terms of areas with similar problems: 'new districts'; those suitable for restudy under the 'delayed-return' type of project; 'critical regions'; and 'culture-change regions'. Professor Elkin rightly stresses the need for cooperation between governments, missions and anthropologists. More than once he urges the appointment of government and mission anthropologists. Such cooperation should be of great benefit to both parties. The anthropologist can throw much light on practical problems, and at the same time he will be provided with wider opportunities for testing and refining his scientific theories. The author's insistence upon an analytical view of the situation, upon clearly visualising the fields of psychology, linguistics, and 'social and cultural anthropology' is probably carried to a point where it becomes a barrier to a clear functional view of their interdependence in the whole situation. This is particularly so in his constant separation of 'social' from 'cultural' elements. The social structure is just as much a part of culture as are ideas and attitudes, and there is no guarantee that a 'reverberation or chain reaction' in the 'culture' will not affect the 'social structure'.

But no academic argument should be allowed to obscure the great contribution which this book makes to anthropology today. Not only is it a kind of semicentennial stocktaking of the anthropological literature on this region, and a valuable guide for future research; it is also the anthropologist's answer to those who question the value of social anthropology as a discipline. It points the way to a greater cross-fertilisation between 'pure' and 'applied' anthropology than has hitherto been the case in Melanesia. The book should be read both by anthropologists and administrators.—R. R. NAYACAKALAU

A CLIMBER'S MANUAL

THE SOUTHERN ALPS: Part II. By Rob Hewitt and Mavis Davidson. Christchurch: The Pegasus Press, 1953, pp. 56.

The writers of this booklet, another in the generally admirable series of New Zealand Holiday Guides, have produced a companion to Mr. Pascoe's *The Southern Alps: Part I; From the Kaikouras to the Rangitata.* This last gave the mountain-interested public a selective account of the area, and included an apparently casual, but nonetheless accurate, grading of the principal routes on peaks and across passes. For good measure a stimulating selection of historical and topographical gleanings were incorporated. Mr. Hewitt and Miss Davidson, in *Part II; The Mount Cook Alpine Regions,* have a difficult task. Although their area comprises only the eastern side of the main divide from the Macaulay Valley to the Mueller Valley, they are dealing with what has always been the heart region of New Zealand climbing, as crowded with name and incident as covered with snow and ice. The writers have noted within the short space of fifty-six pages virtually all the named peaks and the known routes up them. Such total, unselective coverage is unfortunate. At times it leads to nothing more than verbalised map reading:

> 'Proud Pass, about 7200 ft. From Hooker Gl. up on to small glacier, thence to pass
>
> Turner Pk. (Proud Pk.) 7679 ft. From Proud Pass or Ball Pass.'

The authors' stated endeavour 'to make available to those who come to these regions information that will assist them to decide which mountains they are sufficiently experienced to attempt and which routes they are most competent to perform' has not been positively developed. It is not adequate to note in the beginning that climbers should consult the chief guide. The time has come when, in the interests of safety and guidance, New Zealand climbers must make some attempt, even if tentative, to assess comparatively the difficulty of climbs as is done in European guide books. The relatively well-known and frequently-climbed Mount Cook district affords the best and most urgent area for a start to be made; and this holiday guide provides the right opportunity. As it stands, the book singles out very few routes not for the novice, and even fewer for him.

To the more general mountain visitor, attracted by the earlier guide of Mr. Pascoe, there is a dearth of historical or topographical comment, and consequently the guidebook provides barren reading. It is to be hoped that the promised Franz Josef and Fox Glacier guide will receive treatment along the lines suggested but not followed by Mr. Hewitt and Miss Davidson, and if it were to do no more than tentatively to grade the climbs described, it would live up to its name.—W. P. PACKARD

CARTOGRAPHY AND THE FACE OF THE EARTH

MAP AND LANDSCAPE. By Dorothy Sylvester. London: George Philip and Son Ltd., 1951, pp. 287.

MAPS AND DIAGRAMS. By F. J. Monkhouse and H. R. Wilkinson. London: Methuen and Co. Ltd., 1951, pp. 330.

THE LOOK OF MAPS. By Arthur H. Robinson. Madison: University of Wisconsin Press, 1952, pp. 105.

ELEMENTS OF CARTOGRAPHY. By Arthur H. Robinson. New York: John Wiley and Sons, Inc., 1953, pp. 245.

GEOGRAPHY FROM THE AIR. By F. Walker. London: Methuen and Co. Ltd., 1953, pp. 106.

OUR WORLD FROM THE AIR. By E. A. Gutkind. London: Chatto and Windus, 1952, pp. 250.

The title of the first of the three parts of *Map and Landscape* is 'The Grammar of Map Reading and Field Work'. 'The Grammar of Map Reading' could well be the title for the whole book, for the relation this work bears to the full geographical interpretation of landscape in its widest connotation is that which the formalised grammars and syntaxes of thirty years ago bore to the rich fullness of the literature of the language whose bones they exposed. Arrangement and minor details apart, there is little that is new in this book. It depends exclusively on British examples. This lessens its value in any place where Ordnance Survey maps are not at hand. Part II, which treats the study and interpretation of maps, whilst very sound on the physical side, fails to achieve that final integration necessary for the recognition and description of geographic regions. In Part III the assurance that much of the material is presented for the first time is difficult to accept. Almost every trick of drawing and geometry as applied here to maps has appeared several times before. For New Zealand it will be just another mapwork book with little not already offered by its several predecessors and contemporaries.

An unpretentious title, *Maps and Diagrams,* proclaims an honest, forthright book. It is not lavishly produced, and introductory discourses, philosophical comment and historical asides are kept to a minimum. There is a tautness about the book which emphasises that it has, as its major task, the guidance of the geographer of average training in the production of maps which clearly express his ideas. The book sets about this in a workmanlike manner. The style of writing is economical but eminently readable. There are just on two hundred figures, nearly all of which are closely linked with their textual references. It is very difficult indeed to avoid a mental comparison of this book with Raisz's *General Cartography* with its large format and lavish illustrations. As an aid to the geographer, however, the two books are not strictly comparable. Raisz's book is a review by a professional cartographer of hi whole field with any really practical hints more or less as asides, but Monkhouse an Wilkinson have restricted themselves to the immediate necessities of the amateu cartographer. They offer valuable practical guidance to all geographers who hav conclusions to present graphically.

The Look of Maps is not for the learner wanting specific working instructions It is a book aimed at all who consider themselves expert already, and its purpos is to cause them pause and make a critical inventory of their stock of time-honoure conventions. It does this so effectively that after laying the book aside it is impossibl for one's old familiar concepts to appear as substantial as they were. In a beguilingly easy manner Dr. Robinson demolishes one by one the validity of cartographic concepts which have been recognised as sound—sound because it has always been assumed that their survival was based on obvious superiority. He sets out to show that more often than not their perpetuation is due to inertia or obeisance to some outmoded technical process.

The recurrent theme of this little volume is the functional evaluation of maps from a visual viewpoint; from the viewpoint of the harmony and aptness of lettering, colours and overall design. There is a vital manner in which Dr. Robinson differs from the usual iconoclast. He does not destroy the accepted for destruction's sake. He is willing to admit that brown may be the best colour to use for contours, but that if it is, it is not because it recalls 'the freshly tilled soil in the spring' but possibly because it combines maximum transparency with solid body and harmonises with other colours used. Another of his reasoned thoughts is that there is nowadays no valid reason for having north at the top of a map. Perhaps the most strikingly simple example he provides is the hallowed use of spectrum-based scales for altitude tints· red for the hill tops, orange for the slopes, green for the lowlands, blue for the coastal seas and indigo for the ocean deeps. He points out that the gradations of the spectrum and the visual perception of the human eye have no proven correlation.

The functional approach is advocated throughout. Why, Dr. Robinson argues, should we perpetuate maps which do not incorporate the latest proven techniques to make then fit their purpose? The relevant researches of the psychologist, the artist, the typographer, the display advertiser, the physicist and the photographer should all be called upon and applied. In most other fields of functional art, technology has kept pace, but in cartography the mechanics of reproduction are still, he recognises, a limiting factor preventing the optimum employment of the elements of lettering, structure and colour.

There is one criticism, however. The book, apart from a gradation scale of a type to be found in any elementary treatise, has no illustrations. The author has an explanation for this, but it does not entirely dispel the feeling that many of his statements could have been pointed more effectively by carefully prepared plates. However, had illustrations been used they would in many cases have had to be in colour, and the added expense may have denied publication of what is a most refreshing series of mature thoughts from a trained geographer with a uniquely wide cartographic experience. This book has the power to jolt, to stimulate, but not necessarily to formulate clear-cut alternatives for things condemned.

Even if assessed solely on its merits as a practical exposition of several of the more concrete points made in *The Look of Maps,* Dr. Robinson's *Elements of Cartography* is a welcome contribution to cartographic literature. But it has so much more to offer. In its own right it is an up-to-the-minute reference text of particular value to geographers, for it strikes a long-awaited mean between the overgeneralised comprehensiveness of Raisz and the purposely narrow confines of Monkhouse and Wilkinson. The book is excellently produced, with clear, unambiguous diagrams and illustrations throughout. James Flannery's drawings convey Dr. Robinson's original ideas very faithfully and succinctly.

The treatment of map projections, which neatly avoids the too vague or the overmathematical approach, is designed to enable the geographer to select, on quantitative criteria, the optimum map projection for his purpose of the moment. It might be suggested, however, the six pages taken up by catalogue cuts of drawing instruments in Chapter 5 could have been used to better advantage.

Now that stick-up type has replaced hand lettering for all but restricted purposes the chapter on typography is a timely corrective to many of the errors commonly made in type face selection for maps. The sections on the use of colour, on symbolisation and map design and reproduction are all satisfyingly abreast of current technological trends. Eight appendices of strictly relevant and useful tables do much to make the book a complete self-contained reference. The cost factor has no doubt prevented the inclusion of any of the several coloured plates which could have been used to telling advantage.

The keynotes of the whole book are the placing of functional significance before empirical convention and of simplicity and accuracy before ornate and abstruse complexity. All the useless dead wood of the cartographic tree is heavily pruned. It is interesting to note that this American book, dealing primarily with medium and small-scale mapping, is in many respects a complement to the British *Maps and Diagrams* which is concerned with large-scale mapping of small areas, and that together the two volumes constitute a very compact and more complete source of reference than has hitherto been available to geographers.

It is apparent that the compiler of *Geography from the Air* is fully aware of the limitations of his medium for he does not make extravagant claims for aerial photographs as a substitute for fieldwork in geography, but soberly sets forth what he considers to be their role as a valuable adjunct to it. The ninety-six plates with their 111 vertical photographs, three of which are set out for stereoscopic viewing, are well reproduced from originals which exhibit run-of-the-mill unevenness in photographic quality. They are gathered into six groups of sixteen untitled plates, each group being set in the middle of a chapter and preceded by a single page index giving locational details. Possibly, if each photograph carried this information as a caption and was bound separately in juxtaposition with its description and interpretation, wear and tear on both book and reader would be reduced, and the value of the former enhanced considerably.

A visual index in the form of a map of Britain with the principal point of each photograph plotted would be a useful addition. Such a map, incidentally, would reveal that for a text dealing with the geography of Britain, the coverage is rather unbalanced. A quarter of the photographs depict country within a hundred square miles of Bristol and a quarter of the remainder, areas in an equally restricted belt in the Southern Uplands of Scotland, whilst a circle of thirty miles radius centred on London yields only one photograph—that of a few glasshouses in the Lea Valley. East Anglia is missed entirely. In fact from the Wash to Bristol, a belt stretching from the east coast to the west is represented by one solitary print taken near Birmingham. The author's note that 'security precautions make it impossible to include large-scale photographs of important ports, docks or canals' no doubt explains some of the omissions, but not the undue concentration on two localities. However, even if *Geography from the Air* does not fulfil all its promise, it renders a very valuable service by providing, in a manner hitherto unexcelled, splendid material for detailed study by students wishing to acquire facility in the basic techniques of the geographical interpretation of vertical air photographs.

One excursion through Dr. Gutkind's *Our World from the Air* has the effect not only of making one realise how close the author has come to achieving the impossible feat of giving a purposeful synoptic view of the entire world through 400 aerial photographs, but also of arousing a desire to embark on the pleasant journey several times and at increasing leisure.

As the three excellent indexes, diagrammatic, subject and location, reveal, there is really a world-wide coverage. It could be argued that one photograph of each is inadequate for countries as large as Brazil and India, just as three photographs, one of Australia and two of New Zealand, are insufficient to give any true representation of the whole Pacific area. Further, these particular photographs are *per se* open to criticism. The difficulties cited by Dr. Gutkind which prevent free use of suitable photographs apply neither to Australia nor to New Zealand, yet coverage of the former continent is limited to a view of a few Murray Valley orchards, whilst New Zealand is presented through the medium of a technically poor print of the Lower Hutt Valley entitled 'Wellington Harbour' and a third-rate view of Queenstown. The credits for both are 'Dept. of Tourist and Health Resorts'. It is conceivable that the combined resources of all government departments, the N.Z. Aerial Mapping Co., Mr. V. C. Browne and Whites Aviation could readily have yielded superior contributions.

In many instances inherent value rather than technical quality has been the basis of selection. With Count Zu Castell's unique views of Chinese landscapes this is sound, but it is open to question in the case of such easily duplicated photographs as that of the Belvedere Palace in Vienna or the first of the two photographs of Johannesburg. Outstanding in quality among the views of less accessible places are those of Iran taken by the Oriental Institute of the University of Chicago.

Our World from the Air is a book which can yield as much to the trained observer on the tenth perusal as on the first. From the comparison of ribbon settlement patterns in a Kyushu village with those of London's outskirts to the breathtaking view of a vast expanse of Ohio farmland, through the whole gamut of walled cities, islands, rivers, fields and deserts, it can exert an almost hypnotic fascination. Always however, for this reviewer, the impression is strong that despite considerable conscious striving on the compiler's part, the photographs themselves, individually and collectively, *are* the book and the text and its thesis merely an appendage.—STEWART CAMERON

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